ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

L. W. W. MORROW, *Editor*

ALLEN M. PERRY
Managing Editor

A. E. KNOWLTON
Associate Editor

E. R. SEARLES
News Editor

G. F. WITTIG
Statistical Editor

EARL WHITEHORNE
Contributing Editor

FRANK R. INNES
Western Editor
520 N. Michigan Ave.
Chicago

H. S. KNOWLTON
New England Editor
1427 Statler Bldg.
Boston

PAUL WOOTON
Washington
Correspondent
National Press Building
Washington

JAMES H. RUDD
Publishing Director

What in the World!

There has been a lot of work done in the laboratory to improve utility engineering and the equipment which manufacturers provide, but operating men have jealously guarded their systems from tests which, under functioning conditions, might jeopardize service or cause damage. All the more credit, therefore, to Indianapolis Power & Light and Westinghouse for the first tests to have been undertaken. More than 600 made before a new system of stations, lines and substations was placed in regular service (p. 192).

●

"200,000 Jobs" sounded imposing in the headlines after President-elect Roosevelt revealed his dreams to reporters for a 640,000-square mile experiment in national planning for the Tennessee Valley. It is pleasant to dream and let those who must pay and pay and pay be practical (pp. 183 and 186).

●

"We're just marking time; waiting for something to happen," conclude, in effect, the receivers for Middle West Utilities. Declining earnings and poor markets for new securities preclude any present plans for comprehensive financial readjustments (p. 188).

●

Tip a skyscraper on its side, adapt it to other than office purposes and you have a wholly new problem in electrical distribution, transportation and control. New York's Port Authority has been building a fifteen-story structure 800 ft. long by 200 ft. wide for the co-ordinated handling and distribution of freight by rail and truck. About 120 miles of conduit, 763 miles of wire and many innovations bring energy to 29,280 outlets (p. 198).

Relighted Madison Square Garden averages 72 foot-candles

FEBRUARY 11, 1933

Contents, Copyrighted, 1933, by McGraw-Hill Publishing Company, Inc.

VOLUME 101 . . . NUMBER 6

Status of Middle West Utilities.....188

System Performance Tested with 600 Shorts....192
By E. G. RALSTON and E. H. KLEMMER,
Indianapolis Power & Light and Westinghouse Electric, Respectively

Accounting and Budgeting for Station Operation.....196
By C. D. ZIMMERMAN, *Ohio Edison Company*

Industrial Terminal Innovations.....198

Service Calls Develop New Business.....204

News of the Industry.....177
Installing Conduit Where Excavation is Objectionable.....190
Factory Activity Lags Orders.....191
Cost of Headgates at Comerford Station.....195
Curing Bad Commutation on Roll Drive Motors.....197
Painting a 4,482-Ft. Span.....197
Short-Time Fusing of Copper Cables.205
Insulated Stool Preferable for Safety on Switch Operation.....206

Electrical World articles are indexed in Industrial Arts and Engineering Indexes, available in public libraries.

Published weekly. $5 per year. 25 cents per copy. Central and South American countries, $7. Foreign, $9 U. S. currency, or 45 shillings per year. Canada subscription price (including Canadian duty), $7.50. Entered as second-class matter, January 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A. Cable Address MCGRAWHILL, N. Y. Member A.B.P. Member A.B.C. Number of copies printed this issue, 13,525.

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Greenville, S. C.; Los Angeles. James H. McGraw, Chairman of the Board; Malcolm Muir, President; James H. McGraw, Jr., Vice-President and Treasurer; Mason Britton, Vice-President; Edgar Kobak, Vice-President; H. C. Parmelee, Vice-President and Editorial Director; Harold W. McGraw, Vice-President; C. H. Thompson, Secretary.

Save the unnecessary waste of splicing material

General Cable has made the splicing of lead-sheathed cable joints—rubber, varnished cambric and paper-insulated—one quick, neat, simple, *non-waste* job.

When you buy lead-covered cable, order **GENERAL CABLE UNIT PACKAGES** of splicing materials *to match!* They save time, materials, assembly. They save storeroom space.

Order from your Electrical Wholesaler—or write us for full particulars and prices.

GENERAL CABLE CORPORATION

420 LEXINGTON AVENUE, NEW YORK CITY • OFFICES IN PRINCIPAL CITIES

ELECTRICAL WORLD

Established 1883. McGraw-Hill Publishing Company, Inc.

for the Week Ending

February 11, 1933

Receiver for Lexington Water Power?

PETITION for a receiver for the Lexington Water Power Company, underlying property in South Carolina of the Associated System, on charges that "the business has been extravagantly managed, with money being wasted on large salaries and other expenses," has been made by a holder of debentures of the company on which the January 1 interest due has not been paid.

"The mismanagement is due to the influence of the General Gas & Electric Corporation, with which the company is affiliated, and to the Associated Gas & Electric Corporation, which exercises dominion over the other companies," the petition further states, not only alleging that the property is mismanaged but that it is insolvent and that its stock is watered.

Property of the Lexington company includes the great Saluda Dam, completed in 1930 at a cost estimated at $20,000,000. This is said to be the largest earthen dam in America.

Federal Judge J. Lyles Glenn has given the Lexington Water Power Company until February 15 to show why a receiver should not be appointed.

Reorganization planned

Plans for exchange, under the direction of the General Finance Corporation, of the 5½ per cent convertible sinking fund gold debentures of the Lexington company due in 1953 for 4½ per cent gold bonds of the Associated Electric Company due in the same year on a dollar-for-dollar basis, with cash adjustment for interest, have been under way for some time and it was recently announced that a sufficient number of bonds had been deposited to make the plan effective, an extension in time being made to permit latecomers to join.

E. H. Lewis, vice-president General Finance Corporation, has stated: "We believe that every effort to avoid having any receiver appointed will be made, convinced, as we are, that a reorganization can better be accomplished in the interest of all the security holders without the loss, delay and interference with inefficient operation generally attendant upon any receivership proceeding."

▼

Supreme Court Upholds South Carolina Energy Tax

Rendering its decision in the South Carolina energy tax case (ELECTRICAL WORLD, February 4, page 147) the Supreme Court of the United States has upheld the constitutionality of the state law and followed closely the decision rendered by it over a year ago in the case of the state of Idaho versus the Idaho Power Company.

The most recent decision affects the Broad River Power Company and Lexington Water Power Company, which on various grounds sought to have the South Carolina statute set aside. Similar taxes are imposed, for energy generated or sold within the state, upon power companies in Vermont and to a degree in Alabama. It is proposed that the levy be extended elsewhere (page 180).

▼

Greater Economy Foreseen for Mercury-Vapor Cycle

Cheerfully predicting it to be well within the range of the possibilities of the next few years that with the mercury-vapor cycle energy may be produced for less than 9,000 B.t.u. per kw.-hr. H. N. Hackett of the General Electric Company told the power group of the New York section, American Institute of Electrical Engineers, this week that many old stations could be advantageously and economically modernized by superposing mercury-vapor units on the existing steam equipment.

Darrow Sage of Public Service Electric & Gas Company told the group that the mercury unit at Kearny station, where the meeting was held, might be operating on the line within the month. According to Mr. Sage, the economy at Kearny, planned for the station when it was built in 1925, was approximately 16,000 B.t.u. per kilowatt-hour. With the addition of this first mercury unit operating on a full schedule it is hoped that the efficiency of the whole station may be brought to less than 14,000 B.t.u. per kilowatt-hour.

The Kearny installation differs in many respects from early experimental plants, the two commercial installations of the Hartford Electric Light Company and the new outdoor station of General Electric at Schenectady. Notable is the use of mercury-wall construction on four sides of the furnace.

▼

U. S. Supreme Court Holds 77% "Not Affiliation"

Holding that though the American Gas & Electric Company owned all the common stock of the Atlantic City Electric Company and 77 per cent of the total preferred and common stock of the operating organization this did not constitute "affiliation" "or substantially all the stock" within the meaning of the federal revenue acts, the Supreme Court of the United States has denied the appeal of the utility organizations that consolidated tax returns be admissible.

This decision, sustaining the Circuit Court of Appeals for the Second Circuit, took into consideration the fact that the Atlantic City Electric Company was operated independently of the American Gas & Electric Company and was neither physically connected nor merged with that company.

Several Groups Resume Insull Fact Finding

CREDITORS of the Middle West Utilities Company have joined with holders of Middle West gold notes totaling $40,000,000 to ask Judge Lindley to authorize and set a date for a hearing to discover assets under the federal bankruptcy act. Under such a hearing the creditors and noteholders would seek to show that Middle West directors illegally pledged assets having a face value of $95,000,000 with four banks as additional collateral on loans totaling $27,007,000. Similar suits have already been filed in the case of Insull Utility Investments, Inc., and the Corporation Securities Company.

On the petition of attorneys for Calvin Fentress, receiver of Insull Utility Investments, Inc., asking for review and reversal of the decision which disqualified him as trustee of the company (ELECTRICAL WORLD, January 21, page 83) Federal Judge George A. Carpenter has decided to open up the entire Insull bankruptcy situation. The purpose of the court is to determine the merit of charges that Samuel Insull and his former bankers "framed" the receivership of the various Insull investment companies to benefit themselves. Judge Carpenter set the case for February 14.

Federal Trade hears case

Further testimony relative to Insull companies, including the National Electric Power Company and the National Public Service Corporation, both in bankruptcy, was presented to the Federal Trade Commission last week. W. H. England, commission economist, testified that in August, 1932, the National Electric Power Company pledged $58,649,065, or approximately 90 per cent of all of its securities owned, as collateral for loans and as security for accommodation paper. The commission was told that if the value placed upon stock dividends and unrealized profits on sales of securities to subsidiaries, amounting to $2,891,957 included in earnings, were excluded there would have been a deficit in the company's earned surplus account at the close of 1931 instead of a surplus of $1,070,322. Testimony covering the National Public Service Corporation indicated that the company had pledged $61,676,286, or 95 per cent of the total securities owned, as collateral for bonds, bank loans and as securities for accommodation paper.

Chase National Bank has purchased for $4,068,000 at public auction the collateral securing a defaulted loan of $5,485,051 which it had made to the National Electric Power Company. No other bidders appeared. An amount of $1,417,051 and accrued interest is still due the bank, for which it is expected to maintain its claim against the bankrupt estate. The bank also purchased for $68,000 a lot consisting of $392,500 principal amount of debentures of the National Public Service Corporation. The sum of $4,000,000 was paid for a promissory note of the Seaboard Public Service Company, bankrupt subsidiary of National Public Service, which is secured by various stocks and bonds and by other promissory notes. The note, originally for $6,000,000, had been reduced to approximately $5,485,000.

As the result of an order handed down by Federal Judge Walter C. Lindley last week an eight-million-dollar Insull dam project on the banks of the Colorado River in Texas is likely to remain unfinished. The project is only partially built. Judge Lindley's order denied a motion of Eugene V. R. Thayer, receiver for the Mississippi Valley Utilities Investment Company, to enter into an agreement with the Colorado River Company for completion of the project. Under the proposed agreement it was planned to obtain a $5,000,000 loan from the Reconstruction Finance Corporation to resume work.

Announcement was made this week that the Ministry of the Interior has granted full liberty of movement in Greece to Samuel Insull and that he is free to leave the country should he so desire.

▼

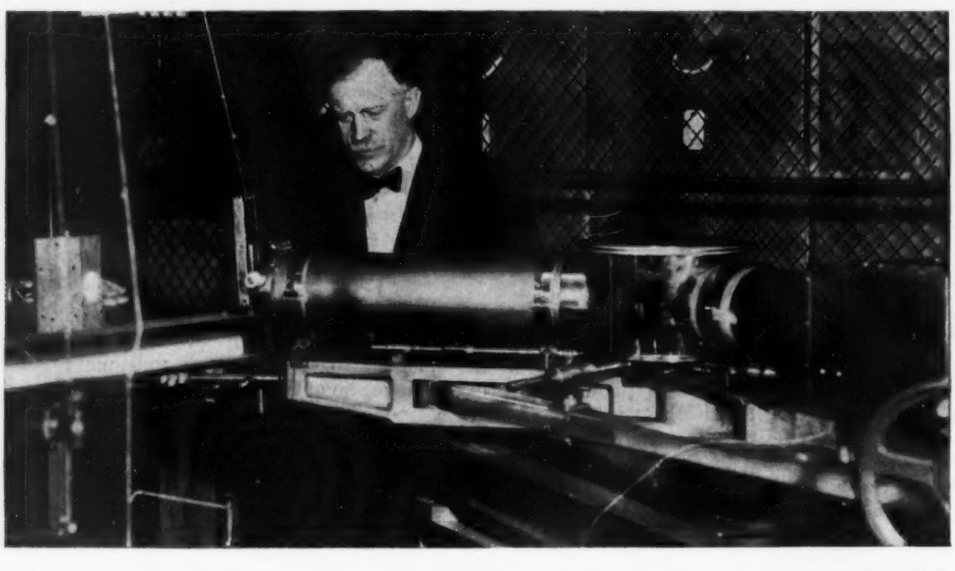
Hartford Range Rental Quickly Accepted

By Tuesday noon of this week 380 electric ranges had been rented to the public by the Hartford Electric Light Company on the $1.30 per month plus energy charge plan launched February 1 and described in the ELECTRICAL WORLD of February 4, page 151. Of this total local dealers rented 100 and the company received applications for a total of 440 ranges, including 60 customers who were undecided whether to rent or buy ranges.

The company's announcement that free wiring would be furnished to the first 500 installations rented and that applicants coming to the office in person would be given preference up to noon on February 1 led to the receipt of 142 applications during the forenoon of the opening day. Widespread appreciation of the company's offer has been expressed. The demand for rented ranges has neecssitated the placing of three orders for 100 more ranges each with the manufacturer since the beginning of the rental program.

▼ ▼ ▼

To Aid Research in the Ultraviolet Spectrum



One step nearer draws the ultimate knowledge, now but imperfectly held, of the ultraviolet spectrum and of the qualitative and quantitative factors involved. By means of this monochromater recently completed at the Nela Park laboratories of the General Electric Company by Dr. W. E. Forsythe it is possible to select one wave length of light from the spectrum and measure its characteristics fully. This device, several years in the making and obtaining of materials, is used to study the ultraviolet, visible and infra-red radiation from various light sources and to extend exact knowledge of their applications to medical and other fields.

Duty to Advise on Rates Pointed by Illinois Board

That it is the duty of utility companies to advise their customers of new rates advantageous to the user and to assist him in the selection, where an optional rate is available, is pointed out in a recent order of the Illinois Commerce Commission.

Holding that "reasonable diligence in furnishing information and advice to a customer on an important rate matter was not exercised" by the Central Illinois Public Service Company, the commission has ordered that company to make reparation to N. Berkowitz & Son, a corporation operating a refrigeration plant, for charges made from 1923 to 1931 "at a rate much less favorable to it than the rate complainant logically would have selected."

Since 1920 the refrigeration company had been on a commercial power rate. In 1923 the utility company filed with the commission an optional off-peak rate applying to electric energy supplied for ice making and refrigeration purposes.

The commission in its recent order pointed "a distinction between actually making the choice for a customer, as between optional rates, and furnishing the customer with reasonable information so that the customer himself is in proper position to make the choice." The commission found that "information had been given to other customers," but that the company "took no steps whatever to inform the complainant of the existence of the new and more favorable rate."

▼

Minnesota Governor Urges State Power Development

"In order to secure more industries and bring about the local manufacture of farm products and other raw materials produced in Minnesota cheap power is necessary," Governor Floyd B. Olson told the state Legislature when it met. "To secure this the people must own a transmission system connected and interconnected with the available source of electrical energy. A network of transmission lines would make electrical energy available to every city and village at lost cost. Power can be secured from the many dams now built or to be built on the Mississippi River. I recommend that you submit to the people of this state a proposed amendment to our Constitution that will permit the state of Minnesota to build and operate district power plants within the state and to sell electricity generated therein to municipalities and to the public.

"The railroad and warehouse commission should be given authority to prohibit capital expenditures by public utilities operating within the state, except where regulated by local franchise, and to prohibit the sale of stock outside the boundaries of Minnesota by public utilities, unless permission is first applied for and granted by the Railroad and Warehouse Commission.

"I advocate an increase in the percentage rate of gross earnings taxes upon public utilities. They should pay the same amount of tax under the gross earnings tax system as they would be obliged to pay if they were subjected to a property tax. They now pay considerably less. If they were subjected to a property tax and compelled to pay on the basis of valuation permitted them for rate-making purposes they would pay a great deal more than they now pay in the form of gross earnings taxes."

Following Governor Olson's plea a bill designed to encourage municipal ownership of plants by permitting such publicly owned systems to extend their lines beyond the corporate village limits was introduced in Minnesota's upper chamber by Senator E. L. Regnier. Another bill introduced by Senator Regnier at the same time is intended to "alleviate the plight of the small dealer in electrical appliances by prohibiting sales of such merchandise by privately owned power companies."

Representatives of Minnesota power companies have objected to the proposal to put the state in the electric power business. W. H. Burke, president and general manager of the Minnesota Power & Light Company, asserted that the state has no idea what it would cost to build plants and produce power. He pointed out to the public domain committee of the House that the per capita cost of state and local taxes now are three times what they were in 1913, yet despite that the price of power to domestic users of the Minnesota Power & Light Company is 34½ per cent less than in 1913. Charles Fowler, Minneapolis attorney, represented the Northern States Power Company.

▼

Wisconsin Governor Seeks Stronger Regulatory Laws

Advocating adequate regulation of privately owned public utilities rather than public ownership, Albert G. Schmedeman, Governor of Wisconsin, in a recent message to the state Legislature, recommended that the public utilities regulatory law be sustained and that the Public Service Commission be given every opportunity to make regulation really effective. "In some minor respects," he said, "the present regulatory law needs further strengthening, especially with reference to control over the relations between operating public utilities in this state and foreign holding companies. Appropriately bills to effect this purpose have been prepared by the Public Service Commission and I hope may meet with your approval. The Public Service Commission at my suggestion also has prepared a bill to make it impossible for any utility to cripple the commission by withholding payment of assessments for expenditures incurred in regulation. I feel that the percentage of gross income to be assessed should not exceed 1 per cent. . . .

"I believe in safeguarding the right of the people to own and operate the utilities when regulation fails adequately to protect the consumers. I believe, however, that at this time regulation should be stressed rather than possible public ownership. We have only recently enacted a modernized regulatory law and the commission has already given promise of making regulation really effective. . . ."

Those Ides of March Blues

Uncertain whether to "Beware the Ides of March" or to see "the winter of our discontent made glorious summer by this sun of York" business has those left-all-alone-again-blues.

Figures but reflect the desultory drift that has gone on for the past few weeks. Carloadings about 5 per cent below those for the preceding week and 15.5 per cent under last year. Steel production at 19 per cent of capacity, struggling back to the levels of last June. Energy production, particularly on the Pacific Coast, showing little strength. Commodity prices at a new low for the depression but generously hailed, presumably on the principle of the strategic retreats of war times, because they are not going down at so rapid a rate as formerly. Automobile production affected by labor troubles, but, encouraging to relate, preliminary reports of new car sales and registrations in January indicating that for the first time in three years sales have exceeded those of the month preceding.

Influences of the week: Mr. Roosevelt's hopeful suggestion for the employment of many men in the Tennessee Valley stimulates plans for more federal and state public works at the beneficence of the R.F.C. and the price of higher taxes. Plans for a conference in March on the question of international debts, with the insistence by Great Britain that bargaining and the gold standard be taboo. "Ole debil" inflation raising his rainbow-shrouded head of festering putrefaction to please the shortsighted. Continuation of the endless speculation as to the personnel of Mr. Roosevelt's cabinet, their views and influences. Dividend cuts by some hitherto steadfast recalcitrants in the matter of curtailing stockholder disbursements.

Coming Meetings

National Electric Light Association—Annual convention, New York, Feb. 15. A. Jackson Marshall, 420 Lexington Ave., New York.

Great Lakes Division, N.E.L.A.—Fifth annual sales conference, Chicago, Feb. 16-17. T. C. Polk, 20 No. Wacker Drive, Chicago.

National Accounting Section, N.E.L.A.—Committee meetings. Chicago, Feb. 20-21. A. J. Marshall, 420 Lexington Ave., New York.

New England Division, N.E.L.A.—Engineering Section, Boston, Mass., March 2-3. O. A. Bursiel, 20 Providence St., Boston.

Oklahoma Utilities Association — Oklahoma City, Okla., March 7-8. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City, Okla.

National Sales Section, N.E.L.A.—Committee meetings, Chicago, March 21-23. A. J. Marshall, 420 Lexington Ave., New York.

National Engineering Section, N.E.L.A.—Committee meeting, Detroit, Mich., April 10-14. A. J. Marshall, 420 Lexington Ave., New York.

Maryland Utilities Association—Baltimore, Md., April 21. D. E. Kinnear, 803 Court Square Bldg., Baltimore, Md.

Missouri Association of Public Utilities—Jefferson City, Mo., April 27-29. N. R. Beagle, 101 West High Street, Jefferson City, Mo.

▼

Radio Ordinances Hinder, Says Co-ordination Group

Concluding its report for 1932, the Joint Co-ordination Committee on Radio Reception of the National Electric Light Association, National Electrical Manufacturers' Association and Radio Manufacturers' Association has stated the following to be logical: (1) The increased use of higher power broadcasting stations will insure a better coverage of the country, higher field strength for most communities and will in general improve reception; (2) design of radio sets to have minimum susceptibility to external disturbing fields will materially aid in solving the interference problems; (3) proper installation of radio sets to insure minimum coupling between the antenna and house circuits apt to set up disturbing fields will help; (4) installation of radio frequency filters on devices found to be sources of serious interference will aid in some cases; (5) ordinances relating to radio interference as well as to other technical matters are generally ineffective and frequently set up standards which are in a few years a serious hindrance to the proper solution of the problem.

▼

Central Public Service Reorganized

More than two-thirds of all exchanges of securities proposed in the plan for reorganizing the former Central Public Service System (ELECTRICAL WORLD, December 31, page 868, and November 12, page 644) has been effected. The plan permits deposits of debentures until April 1, 1933, while other securities may be deposited until later dates. The response has run ahead of estimates, and with notes and debentures 70 per cent deposited at the end of last week preferred and class A common-stock deposits had reached totals of 50 per cent and 70 per cent respectively, according to the committee.

▼

Legislators Ponder Many Utility Bills

ENCOURAGED, no doubt, by the stand of President-elect Roosevelt in regard to utilities and their regulation many states have before their legislative houses at present a wide variety of restrictive measures designed to affect the electric light and power companies. They run the old familiar gamut of the anti-merchandising, anti-holding company, anti-monopoly, anti-corporation, anti-alleged high rates and pro-tax courses.

So high is the mortality of such measures as indicated by the past histories of others that it is scarcely worth while to attempt a listing of any but the more indicative ones and is unconscionably hazardous to guess at which may reach any greater maturity.

ALABAMA—Sales tax on energy; 1 per cent for industrial use, 2 per cent for domestic; not to be paid by consumer.

CALIFORNIA—Would permit revenue bonds to aid municipalities to establish power plants. Would make commissioner elective office subject to recall.

CONNECTICUT — Would authorize a commission to investigate present public utility law. Would authorize commission to join with those of other states for interstate regulation. Would let commission initiate rate hearings.

GEORGIA—Would remove legal bar to municipalities jointly to provide funds to hire lawyers or experts to represent them before the commission. Would make tax basis the basis of valuation in establishing fair return to the utility. Would aid financing of municipal projects. Would provide legislative committee to investigate properties and returns upon investment.

ILLINOIS—Would prohibit utility merchandising. Would prohibit public servants whose duty involves regulation or enforcement of laws covering utilities to hold securities or have official relations with utilities.

INDIANA—Would reduce numbers and abolish present personnel of commission. Would limit utilities and encourage municipal plants. Would provide sales tax of 2 per cent on domestic energy use and 1 per cent on industrial use, may be passed on to consumer.

MASSACHUSETTS—Would abolish all service charges.

MICHIGAN—Would forbid appliance merchandising.

MINNESOTA — Would increase state control of all hydro projects, patterned after existing Wisconsin law. Would permit the state to own and operate power plants and provide for $50,000,000 to make law effective.

MISSOURI—Would give public service commission control over hydro permits, ostensibly to protect fish and game and scenic factors. Would reduce commission staff and expenditures. Would require justification of all holding company fees. Would tax 1 mill per kilowatt-hour on all energy generated, also on energy imported.

NEBRASKA—Would encourage municipal plants, prohibit merchandising, increase taxes on water power, abolish service charges and place all utilities under jurisdiction of state railway commission. Would establish maximum rates for service.

NEW MEXICO—Would give state corporation commission full jurisdiction over rates and service.

NEW YORK—Would provide for investigation of all elements of the utilities supplying New York City. Would provide definite limits to which service must be extended. Would prohibit appliance merchandising.

NORTH CAROLINA — Would abolish state corporation commission and create a new public utilities commission.

OREGON—Would permit commissioner to judge a utility to be in contempt. Would prohibit merchandising which necessitates charging expenses to operations. Would increase fees received by the state on utility gross revenues by an average of 25 per cent.

OHIO—Would restrict municipal projects by requiring percentage vote on all bond issues.

TEXAS—Would vest utility revaluation in the governing boards of cities and towns, provides 6 per cent return as maximum on assessed valuation.

UTAH—Would tax energy generated in the state ½ mill per kilowatt-hour.

WASHINGTON—Ten years on its way to oblivion, the "Bone" bill has been revived. It is designed to give municipalities the right to sell energy outside the city limits.

WEST VIRGINIA—Would tax utilities ½ mill on all energy generated or sold within the state. Would tax all meters $5 a year.

WISCONSIN — Would limit salaries paid by public utilities to twice that paid for similar work in state service, another would set the maximum chargeable to operating expenses at $15,000 a year. Would require prompt payment of assessments against utilities for regulatory expenses without waiting for results of appeals.

Federal Commission Urged for Utility Regulation

In a bill introduced in the House of Representatives last week the establishment of a Federal Communications and Power Commission, to consist of five members, each with a salary of $10,000 per year, was recommended, the bill being referred to the committee on interstate and foreign commerce, whose expert, Dr. W. M. W. Splawn, is investigating holding companies. President-elect Roosevelt is understood to favor such a plan.

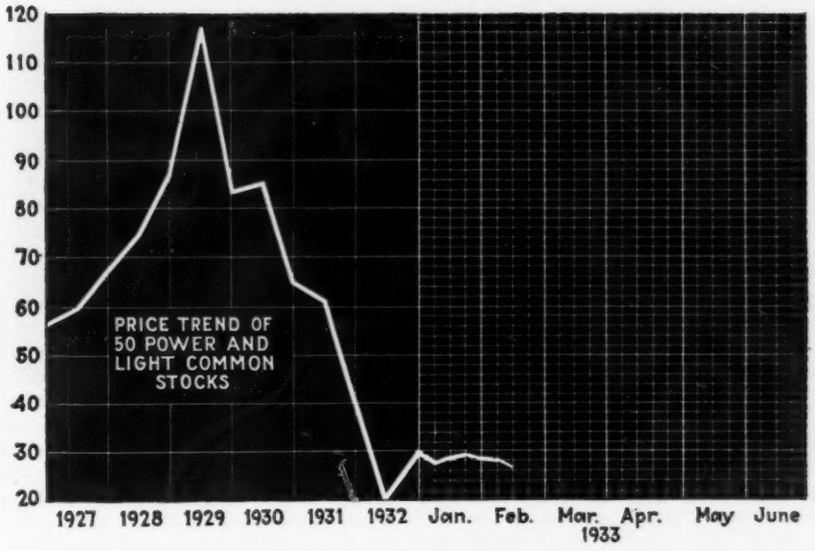
According to the measure the "commission shall administer all laws of the United States: (1) Relating to the regulation of the transmission or communication, in interstate or foreign commerce, of intelligence by wire, or wireless or otherwise by the use of electrical energy, or (2) relating to the regulation of the transmission or sale of power, interstate or foreign commerce, or to the issuance of licenses for the construction, operation and maintenance of dams, water conduits, reservoirs, power houses, transmission lines or other project works necessary or convenient for the development and improvement of navigation and for the development, transmission and utilization of power across, along, from or in any of the navigable waters of the United States, or upon any part of the public lands and reservations of the United States (including the territories), or for the purpose of utilizing the surplus water or water power from any government dam."

▼

Six States Plan Power Compacts

Conferring under the auspices of the New York State Commission on Interstate Transmission of Power, representatives of six states have approved a plan for the regulation of interstate transmission of electricity and gas by compacts between the states, under federal sanction. States represented included New York, New Jersey, Pennsylvania, Massachusetts, Connecticut and Vermont. After agreeing upon a policy of compacts, plans were made for the drafting of agreements to be submitted to the legislatures of the various states, as well as for federal legislation.

Utility Stocks Recede



Utility stocks lost some ground during the past week, receding prices carrying the *Electrical World* index down to 27.0 as compared with 28.9 for the preceding week.

▼ ▼ ▼

West Virginia Orders Broad Utility Inquiry

By a vote of 86 to 4 the House of Delegates of West Virginia has approved a resolution introduced by Delegate Holt providing for an investigation of public utilities in that state through a committee of five to be appointed by Speaker Hiner. After adoption of the resolution, Mr. Holt said the committee's task will be a scrutiny of the workings of the Public Service Commission.

The committee has the power to investigate the rates, rate-making process and financial set-up of any or all utilities operating in the state; to look into the participation of utility employees, officials, companies and corporations in political activity, elections and all other governmental activities; to investigate the activities, rulings and orders of the Public Service Commission; to study the assessment and taxation of utilities, or to investigate any other matter dealing with utilities that the committee may determine to be of common good to the citizens of the state.

▼ ▼ ▼

Current Earnings Reports of Electric Light and Power Companies

Operating Companies

	1932	1931	Per Cent Increase	Operating Ratio 1932	Operating Ratio 1931
Alabama Power (Year ended December 31)					
Gross earnings	$15,538,839	$17,758,442	—12.4	48	49
Net earnings	8,039,089	9,081,880	—11.5	..	..
Net balance	1,114,516	2,225,185	—49.5	..	..
Consumers Power (Year ended December 31)					
Gross earnings	27,931,248	30,860,143	— 9.5	52	51
Net earnings	13,439,271	15,074,823	—10.8	..	..
Net balance	4,776,210	7,024,287	—31.8	..	..
Georgia Power (Year ended December 31)					
Gross earnings	22,416,127	25,037,080	—11.5	49	53
Net earnings	11,515,203	11,699,491	— 1.0	..	..
Net balance	2,326,279	2,874,630	—19.0	..	..
Ohio Edison (Year ended December 31)					
Gross earnings	15,607,891	17,933,138	—13.0	48	45
Net earnings	8,178,440	9,847,998	—17.0	..	..
Net balance	2,556,469	4,475,889	—43.0	..	..
Tennessee Electric Power (Year ended December 31)					
Gross earnings	11,743,675	13,662,433	—14.0	57	58
Net earnings	5,019,059	5,675,954	—11.5	..	..
Net balance	819,366	1,797,317	—54.0	..	..

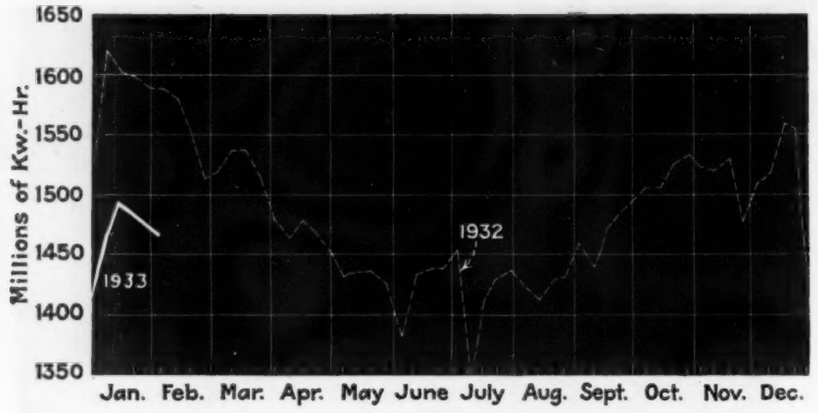
Holding Companies

	1932	1931	Per Cent Increase	Operating Ratio 1932	Operating Ratio 1931
Commonwealth & Southern and subsidiaries (Year ended December 31*)					
Gross earnings	$114,513,921	$130,116,633	—12.0	54	54
Net balance	4,247,694	13,374,116	—68.0	..	..
Engineers Public Service and subsidiaries (Year ended November 30)					
Gross earnings	46,731,515	52,625,020	—11.4	64	65
Net balance	2,109,596	3,963,206	—47.0	..	..
United Light & Power and subsidiaries (Year ended November 30)					
Gross earnings	79,781,452	88,034,529	— 9.5	68	68
Income from subsidiaries	8,171,637	11,196,087	—28.0	..	..
Net balance	1,512,884	4,338,274	—65.0	..	..

*Preliminary statement.

Gross earnings — (Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings — Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Income from subsidiaries — Balance available from income of subsidiaries for holding company. Net balance — Balance available from income for common stock dividends.

Week's Output Off 8.4 per Cent



During the past three weeks the electrical energy output of central stations has been decreasing at the rate of about 1 per cent each week. A decrease at this season of lengthening daylight is normal; the recent change has been similar to that occurring last year but slightly greater. The 1,454,913,000 kw.-hr. announced by the National Electric Light Association is 8.4 per cent less than in the corresponding week of 1932, whereas in the week of January 14 the difference was 6.7 per cent.

In the Central industrial region the decrease from 1932 was 11 per cent, approximately the same as in the past few weeks. Along the Atlantic seaboard the divergence has risen again to 7.8 per cent. The greatest changes have been those reported for the Pacific coast, now down 8.8 per cent against 2 per cent in the week of January 21.

Weekly Output, Millions of Kw.-Hr.

Week Ended	1933	1932	1931	1930
February 4	1,455	1,589	1,679	1,782
January 28	1,470	1,589	1,687	1,809
January 21	1,484	1,598	1,713	1,826
January 14	1,495	1,602	1,717	1,834
January 7	1,461	1,619	1,714	1,816

Per Cent Change from Previous Years

Region	Week Ended Feb. 4	Jan. 28	Jan. 21
Atlantic Seaboard	— 7.8	— 6.5	— 6.8
New England alone	— 8.1	— 6.8	— 7.3
Central industrial	—11.0	—10.9	—10.8
Pacific Coast	— 8.8	— 5.2	— 2.0
United States	— 8.4	— 7.5	— 7.1

▼

Energy Off 9.5 per Cent, States Geological Survey

December output of public utility plants (not central stations exclusively) is reported by the U. S. Geological Survey as 7,127,363,000 kw.-hr., of which 2,771,111,000 kw.-hr. was water power. Compared with December, 1931, the total was down 8 per cent, but water-power production constituted a larger fraction of the whole—39 per cent against 35 a year ago. The decrease in November was 6 and in October 9 per cent. Average daily output was about 0.5 per cent less than in November. Normally there is an increase of about 1 per cent.

For the entire year 1932 the production, 82,939,000,000 kw.-hr., was 9.5 per cent less than in 1931. Water power accounted for 41 per cent, against 33 per cent in 1931.

▼

$75,000,000 Project Abandoned

Plans for a seventy-five-million-dollar power project conceived two decades ago have been discarded by the Potomac River Corporation, organized several years ago by Cleveland and Chicago interests for the development of the project. Major Tyler, army engineer, in a survey made twenty years ago recommended a power house near Chain Bridge on the Potomac River with storage dams on the Shenandoah River at Little Falls, W. Va.; at Brooks Gap, near Broadway, Va.; at Erdes Fort on the Cacapon River near Cacapon, W. Va., and on the Potomac River, near Green Spring, W. Va.

▼

Commission Order Backing Asked in New Hampshire

An amended bill in equity has been filed in the Superior Court by Francis W. Johnston, Attorney-General of New Hampshire, and Louis E. Wyman, special counsel for the Public Service Commission, to enjoin the New Hampshire Gas & Electric Company and Derry Electric Company from continuing certain practices in connection with the owner of their stock, the New England Gas & Electric Association, which is part of the Associated Gas & Electric System. The bill seeks to enforce, under the penal provisions of the statute, the orders previously issued by the Public Service Commission which the state Supreme Court held to be unauthorized by law, though admitting the right of the Attorney-General to proceed against the companies through the Superior Court.

In the name of the state of New Hampshire, the court is asked to enjoin the two utilities from borrowing any money by the so-called open account method, except as may be approved by the commission, and from paying interest thereon except upon terms fixed by the commission; from paying management fees to the J. G. White Management Corporation unless the contract is approved by the commission; from continuing the practice of selling appliances on behalf of the Associated Appliance Corporation; that the purchase of the Derry company by the New Hampshire company be annulled and that the latter be enjoined from paying any sums on account of the purported acquisition, unless the commission shall authorize the same; that the local utilities be enjoined from permitting their employees to sell stock of the Associated Gas & Electric Company during hours when they are engaged to work for the utilities, and that the two companies be required to keep their original records in the state and enjoined from contributing to the maintenance of a general office staff outside of New Hampshire.

▼

Advice of Electrical Men Sought

As the first step in an investigation that will cover all phases of the depression, including unemployment, monetary reform, tariffs, foreign trade, banking reform, war debts, etc., the United States Senate finance committee telegraphed invitations last week to 52 of the nation's most prominent men to appear before it, either in public or confidentially, to give their diagnoses of what is economically wrong with the country and the world. Among the electrical men whose advice was sought are Owen D. Young, chairman of the board of the General Electric Company; Gerard Swope, president of the General Electric Company, and A. W. Robertson, chairman of the board of the Westinghouse Electric & Manufacturing Company.

▼

Secretary Wilbur Favors New Colorado Project

In an announcement made recently Ray Lyman Wilbur, Secretary of the Interior, has expressed his approval of the proposed contract between the United States and the Metropolitan Water District of Southern California, involving the construction of a $13,000,000 dam on the Colorado River. The proposed dam, to be located just below the mouth of the Bill Williams River, will raise the water level about 70 ft. and enable

generation of approximately 80,000 hp. of electric energy.

All of the money will be advanced by the Metropolitan Water District and construction will be effected by the United States, which will retain ownership of the dam. The dam will be for the joint benefit of the district and of Indian and public lands in Arizona. In return for its service, the United States will retain one-half of the power privileges. About 40,000 hp. will thus be required for use in Arizona without capital investment, thereby advancing by many years the feasibility of reclamation of large areas in the Colorado River Indian reservations and the proposed Gila project in Arizona.

▼

Roosevelt Proposes Tennessee Valley Be Developed for Relief

ESTIMATING that, by reforestation and the construction of flood control basins to produce a steady flow of the Tennessee River, 2,000,000 to 3,000,000 hp. can be produced at Muscle Shoals, where the federal government has already spent $165,000,000 on what has been both a national problem and scandal, President-elect Roosevelt last week told correspondents of plans for a co-ordinated development of that region. Shortly after March 4, announced Mr. Roosevelt, various governmental agencies will be asked to make surveys so that he may present the entire project to Congress as soon as possible.

As outlined by Mr. Roosevelt, the Tennessee River project, involving half a dozen states, will include:

1. Reforestation of the hillsides of the watershed.
2. Creation of flood-control basins in the upper valleys of the Tennessee River watershed, of which the most important would be that at Cove Creek.
3. Water-power development, beginning with full utilization of the plant already built at Muscle Shoals, to provide cheaper power for residents of cities, states and farms.
4. Reclamation for farm use of the fertile bottom lands of the river, in which farming is now prevented by frequent floods.
5. Elimination of the unprofitable agricultural lands by reforestation.
6. Improvement of navigation.
7. Stimulation of decentralized industry in the region by the supply of cheap power.

But the first of several projects?

"If the project is successful, and I am confident it will be," said Mr. Roosevelt, "I think the development will be the forerunner of similar projects in other parts of the country, such as in the watersheds of the Ohio, Missouri and Arkansas rivers and in the Columbia River in the Northwest. It will be probably the widest experiment ever conducted by a government." He estimated that 200,000 men would be put to work in the Tennessee watershed alone.

Mr. Roosevelt said that the Tennessee River basin had an area of 640,000 square miles and included parts of Virginia, North Carolina, Tennessee, Alabama, Mississippi and Ohio. Flood-control benefits would extend to parts of Illinois, Missouri, Arkansas, Mississippi and Louisiana.

Norris in ecstasies

Senator Norris, long a proponent and indefatigable worker for such federal water-power developments as Muscle Shoals and Hoover Dam, was jubilant at the prospect, adding one more fallacy to a problem already replete with them. "Complete development over the Mississippi Valley," said Senator Norris, "will give all that country a navigability away ahead of what it is now and make power so cheap that the people won't even stop to turn it off in daytime."

Major General Lytle Brown, chief of army engineers, told Congress an industrial development could be launched with that navigable stretch of river to yield millions of tons of water freight. He foresaw an ultimate power development costing $1,200,000,000 to produce 3,000,000,000 kw.-hr. a year at a cost of 4⅓ mills.

▼

Large Arc-Welded Tank Completed in Milwaukee

Construction of a 6,000,000-gal. water-storage tank, reputed to be the largest tank ever constructed, has recently been completed by the city of Milwaukee as the first step in the development of the Menominee Valley Booster station project undertaken to supply sufficient water pressure to cover peak-load conditions in the western and southwestern areas of the city and suburbs. There is not a rivet in the entire shell, making the structure outstanding both as to design and capacity. This innovation in the art of electric arc welding is but further indication that arc welding practice, heretofore considered chiefly a production method, is now rapidly penetrating the construction field.

Actual work on the tank began the latter part of September, by laying a huge circular bed of cement, 165 ft. in diameter, as the foundation for the tank. A coating of asphalt was then laid on this cement bed to form the foundation for the steel bottom plates of the tank itself. The bottom of the tank consisted of steel sheeting ⅜ in. thick, securely welded together. Next the side walls were erected. The first row consisted of sheets 1 1/16 in. thick, weighing 4 tons each, welded to the floor plates inside and out. These plates were placed in position by crawler cranes. Each succeeding row of sheets was slightly thinner than the previous one, in order to allow sufficient room for a satisfactory welding bead on both sides. This entire process of placing the rows of steel sheeting and welding them together was repeated until the top of the tank proper was reached, 37½ ft. high. The entire shell is self-supporting. The height of the entire structure is 57 ft. 3 in. from the ground to the top of the cupola and more than 700 tons of steel was welded together to complete this huge tank.

Major New Construction This Week

Fund of $2,500,000 authorized by Freeport Texas Company for plant and equipment for subsidiary, Freeport Sulphur Company, at Grande Ecaille, La., to include buildings, 5,000-hp. power plant, electric machinery, motors and conveyors.

Motors, controls, transformers, refrigerating machinery, hoists, etc., required for new plant of Allied Brewing Corporation, Long Island City, N. Y. A $1,500,000 project.

City Purchasing Agent, Los Angeles, Calif., asks bids until February 15 for 85,900 lin.ft. lead-covered cable, in sizes of 1,000,000 circ.mil., 500,000 circ.mil., Nos. 4 and 6 A.W.G., etc. (Specification No. 2999). Also, bus insulators and accessories (Specification 2990).

Motors, transformers, compressors, pumps for oil refinery near Holdenville, Okla., to be constructed by Crosby-Moran Company, Tulsa, Okla. Estimated cost $150,000.

Bureau of Power and Light, Los Angeles, Calif., has fund of $22,800,000 for steel tower transmission line from city to Boulder City, Nev., including substations, etc.

Motors, refrigerating equipment, hoists, etc., will be installed by Buckeye Brewing Company, Toledo, Ohio. Cost about $200,000.

▼

New York Metal Prices

	Jan. 31, 1933 Cents per Pound	Feb. 7, 1933 Cents per Pound
Copper, electrolytic	5.00	5.00
Lead, Am. S. & R. price	3.00	3.00
Antimony	5.85	5.80
Nickel ingot	35.00	35.00
Zinc, spot	3.275	3.15
Tin, Straits	23.10	23.65
Aluminum, 99 per cent.	23.30	23.30

North American Light Refunding

Stockholders of North American Light & Power Company will vote February 20 on a proposed increase in the authorized common stock from 2,500,000 to 3,500,000 shares. It is planned to issue warrants permitting them to subscribe to enough additional stock to provide $2,000,000 in cash for use in retiring the $2,000,000 of serial 5 per cent notes maturing on April 1.

▼

Rehabilitation Committee Reports

Rehabilitation projects calling for the expenditure of $155,049,702 by industrial plants and retail business establishments in the United States have been reported to date to the national Committee on Industrial Rehabilitation. This figure, made public February 6 by A. W. Robertson, chairman of the committee and chairman of the board of the Westinghouse Electric & Manufacturing Company, compares with $142,115,351 announced on January 15 (ELECTRICAL WORLD, January 21, page 88).

▼

Allis-Chalmers Net Loss $2,955,043

Preliminary report of the Allis-Chalmers Manufacturing Company for the year 1932 shows net loss after depreciation, taxes, interest and other charges totaling $2,955,043, as compared with net profit of $1,256,431, equivalent to 96 cents a share on 1,312,252 non-par capital shares, in 1931; bookings, $12,316,555, as compared with $22,687,048 in preceding year; unfilled orders on December 31, $5,441,825, against $7,889,332 the preceding year.

▼

Copperbond Absorbed by Crucible

Business of the Copperbond Steel Products Company and its patent rights have been absorbed by the Crucible Steel Company of America. Management of this new division of Crucible will be under W. J. McIlvane, formerly of Bridgeport Brass.

▼

Pension Plan Adopted by Rochester

Adoption of a co-operative retirement program for its 2,000 employees has been announced by the Rochester Gas & Electric Corporation, Rochester, N. Y. The plan is being administered by the Metropolitan Life Insurance Company on a basis whereby employees make regular contributions toward providing their retirement incomes. The corporation plans to provide, entirely at its own expense, pensions equal to 1 per cent of each employee's 1931 salary multiplied by years of service before the plan became effective and as to service after January 1, 1933, to supplement the annuities purchased by employee contributions to such a material extent that the total future service pension for each employee will equal 2 per cent of his total salary from that date to the time of his retirement.

▼

Working Model of Hoover Dam

Engineers of the Reclamation Service are working on a model of Hoover Dam 17 ft. long and 12 ft. high which will be installed at the Century of Progress Exposition in Chicago and so designed as to appear as would the original to one on the rim of the canyon. This will be a working model so that the power plant, discharges and spillways may be operated in miniature.

▼

Savings of $800,000,000 in the federal budget may be effected. We face the choice of continuing on the primrose path of political expediency or resolutely bringing public expenditures within the limits of our capacity to pay. The issue is up to the Congress and to the President, but, above all, it is up to the people of the country.

HENRY I. HARRIMAN,
President Chamber of Commerce of the U. S. Chairman, New England Power Association.

[Mr. Harriman, speaking on the radio this week, urged both economies and wisely planned taxation to effect balanced budgets and minimize the influence of "The Dead Hand on Industry."]

▼

Baltimore Inspection Protested

Customers of the Consolidated Gas, Electric Light & Power Company in the suburban area adjacent to Baltimore have filed protest with the Public Service Commission of Maryland against a regulation of the company requiring a certificate of wiring inspection for buildings within a zone extending 5 miles from the city limits, to be issued by the Baltimore Association of Fire Underwriters. Complainants represent that the enforcement of this regulation is unreasonable and illegal because the rate charged by the Baltimore Association of Fire Underwriters is unreasonable and exorbitant, in some instances being more than four times the rates charged in the rural zone farther from the city.

▼

Wisconsin Utilities Merge

Announcement has been made of the consolidation of the Standard Gas & Electric Company's two Wisconsin subsidiaries, the Wisconsin Public Service Corporation and the Wisconsin Valley Electric Company and affiliates, serving contiguous territories in central and eastern Wisconsin. The Public Service Commission of Wisconsin has approved the consolidation and authorized the issuance of the necessary securities to effect this merger.

Steam Research by A.S.M.E.

As part of an international search for accurate knowledge of the properties of steam at high pressures and temperatures the American Society of Mechanical Engineers has virtually completed a twelve-year investigation which is said to be the most elaborate, precise and complete study of the thermal properties of steam ever attempted.

▼

Fully Automatic Ice Plant

Installation at the refrigerating plant of the Pilgrim State Hospital, Brentwood, N. Y., of automatic compressor unloaders is said to permit full automatic ice plant operations. This development of the Electric Machinery Manufacturing Company unloads the compressors whenever they are not at synchronous speed, thus permitting them to restart automatically without manual or bypassing attention by the operator. Other automatic controls are of course also used.

▼

Baltimore Street Lighting

Curtailment of Baltimore's street-lighting service, to meet a cut of $111,000 in the appropriation for 1933, has been agreed to by representatives of Consolidated Gas, Electric Light & Power Company of Baltimore, American Street Lighting Company and the city Bureau of Mechanical-Electrical Service. Bernard L. Crozier, chief engineer of Baltimore, said that as a result of the agreement the candle-power of the electric lights would be reduced in many instances and the number of lights cut down.

▼

Philadelphia Company Taxes Sought

John A. McCann, special assistant United States District Attorney, has filed suit in the District Court of Philadelphia against the Philadelphia Company to obtain return of $3,283,384 which, it is alleged, was erroneously returned to the company as excess payment of taxes from 1917 to 1923, inclusive.

▼

Georgia Utility Probe

There may be a sweeping investigation of properties and rate structures of public utility companies in Georgia. The Georgia house committee on public utilities favors a resolution bearing an appropriation of $75,000 to finance the investigation. P. S. Arkwright, president of Georgia Power, testified that the investigation would cost more than $400,000 and would require at least a year and a half. He pointed to the act creating the public service commission, contended the commission to have exclusive power to fix rates and denied that the Legislature could do so.

Eye Response Determined for Voltage Dips

Attacking the problem of lighting flicker caused by motor starting from the angle of lengthening the time of application of the starting current, Detroit Edison has conducted some tests to determine how much greater a voltage dip would be tolerated by human eyes when the change extended over a few seconds, as compared with the usual instantaneous dip.

The tests showed that, to the average observer, instantaneous voltage dips of 2.5 to 3 volts were just noticeable, whereas dips of 6 or 7 volts were hardly noticeable when extended over a period of three seconds. This means that the starting current which may be allowed at any point on a system may be more than doubled if a starting device is used which controls the increase of current, so that the change of voltage is gradual or in steps not exceeding 2.5 to 3 volts each.

▼

Explosion Type Boilers Show High Efficiencies

Aroused to alarmed protest at an apparent violation of fundamental scientific principles, European engineers have both condemned and explained the efficiency figures for the new "Velox" explosion type boilers first announced by Brown, Boveri & Company as under experimentation and research in January of last year. Seeking to set at rest the misgivings of doubting Thomases, W. G. Noack of the Brown, Boveri organization has recently pointed out in the *Engineer* (England) that the fuel efficiency of more than 103 per cent is obtained in a measure through an action similar to that involved in the now familiar heat pump first developed by T. G. N. Haldane. Mr. Noack in his discussion relates that an explosion type steam generator has been developed for experimentation which produces 250 kg. of steam per hour with cycles of 50-60 per minute.

The "Velox" steam generator, according to Mr. Noack, operates on the following principle. A combustion chamber which can be closed off by valves is charged periodically with an explosive mixture of fuel and air, the pressure of which is raised through the action of a compressor. A spark plug ignites this mixture, which explodes, with a consequent rise of pressure in the combustion chamber to a multiple of the charging pressure. The highly compressed gases expand through a heating tube to the nozzles of a gas turbine which drives the compressor previously mentioned.

At its extremity the gas tube is surrounded by a flow of cold feedwater, which is thus preheated, and on its length by a flow of the same water, which is then vaporized. The steam generator is thus really the tube section. All sensible heat is drawn from the hot gases in these pipes and a part of the pressure drop to produce the high speed of the gases is used up here. The remainder of the pressure drop of the gases is utilized in the nozzles of the steam turbine and is transformed into mechanical work on the blading of the gas turbine wheel.

The discharge of gases to the turbine goes on until the gases in the combustion chamber have been expanded down to a certain scavenging pressure. A valve then closes and a second discharge valve opens, as well as an inlet valve which admits scavenging air through the pipe branch to drive the residue of the gases out to the atmosphere. This is done through another heating tube and second discharge valve. The residue of the gases is thus expelled and the combustion chamber filled with air. The second heating pipe is also surrounded by a flow of feedwater, which is preheated in this way and then led to the evaporation chamber of a tube section. Once the residue of the gases has been discharged the cycle is repeated.

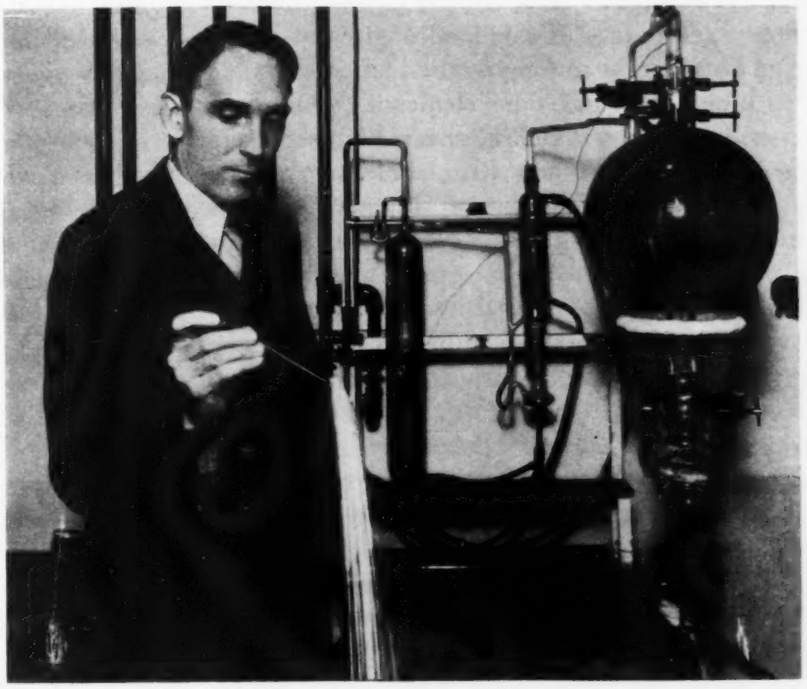
Commercial Brick Making with Detroit Edison Fly-ash

Utilization of fly-ash recovered from pulverized fuel-burning power plants appears to be coming within the range of commercial possibility from experiments that are to be carried on during the next few months at the Trenton Channel plant of the Detroit Edison Company following small-scale trials. The process by which the ash is changed chemically into a suitable material for various building shapes, such as bricks, slabs, hollow tile, etc., was developed by Rostone, Inc., which company is now preparing to exploit the product commercially.

A test plant is now in operation in Detroit and it is expected that within a short time, when the production aspects of the process have been smoothed out, fly-ash brick and other forms of the product will be available on the market. The natural color of the product is a rather light gray, but its eye appeal is not limited to this somewhat neutral shade. By the proper admixture of tinting materials it is possible to produce a variety of colors.

▼

New Electrolysis Widens Rare Metal Use



Rare metals will be made available in larger quantities and at lower prices than heretofore by a new method of electrolysis developed in the metallurgical research laboratories of the Westinghouse Lamp Company. The new process is virtually continuous and involves the use of a solution of potassium and sodium chloride to which the potassium fluoride of the metal desired has been added. The metal collects on a cathode, and in a vacuum induction bottle (the glass globe illlustrated) pressed bars of the metal are heated by induction until transformed into a molten or ductile state suitable for working and drawing into alloys. Dr. Frank H. Driggs, who developed the process, is shown emptying a small glass tube of powdered uranium into the air.

EDITORIALS

L.W.W.MORROW
Editor

The happy valley

MUSCLE SHOALS real estate is again booming. The six-point plan of Mr. Roosevelt revives dreams of the promised land in the Tennessee Valley and will serve to give impetus to schemes for other promised lands, such as the Columbia basin. The climax in the Tennessee plan is the statement of Senator Norris that power will be so cheap that people "won't even stop to turn it off in the daytime."

Public acceptance of this land of dreams is certain to be splendid so long as the plan is so vague as to omit costs and time elements. But some one will strike a balance sheet of costs and returns. Taxpayers may have something to say about pouring more millions of dollars into dams and power houses. Business minds may check the price of lumber and its permanent market against the expense of 70,000 men engaged in reforestation whose crop will mature in some eighteen years. Perhaps the large coal mining industry now busy in that region may measure the value of the plan against the immediate effects upon its business and its employees. Perhaps consideration will be given to producing more abundant crops and more abundant manufactured goods in an already oversupplied market. Even the three or four years necessary to get such a plan started may be pointed out as having a bearing on the effect of the plan on the present depression. Above all, perhaps other sections may attempt to get an equal subsidy for their local territories.

This plan is a stick of dynamite thrown into the sea of depression. It may make a loud noise and create a local disturbance, but it neither threatens the electrical industry nor promises to give the answer to present social and economic maladjustments.

Local chambers effective in justifying demand changes

AGITATION against the "service charge" is cropping out in some quarters as a component of the rising interest of the public in utilities and their practices. Somehow the idea gains ground that the demand element collected in the service charge is horribly discriminating. The facts are just the opposite.

Even when a commission acts as others invariably have done to sustain the equity of the fixed charge in order to preserve the equities and promotional virtue of the block-energy charge the commission pronouncement is seldom couched in terms that satisfy any one but an economic expert. The call is for simple lay language, at least simple enough for the small business man to understand. That suggests letting the small business man in on it.

Regina, Saskatchewan, with a municipal light and power system, faced such a problem a little more than a year ago. It was the Regina Board of Trade which offered the *ex parte* machinery to investigate and report. That report, chronologically many months old, is still refreshingly new in what it reveals. Discounting a few minor points, it is an outstanding example of phrasing the singularities of utility economics so that any one with a modicum of business sense can grasp the essentials of rate practice. It stated emphatically that the demand or "service charge" is

correct in principle and can be made the basis of an equitable distribution of costs. It condemned the minimum charge and the complexity that energy charges alone would have to take on in the absence of the demand charge. But it did all this with a convincingly elementary vocabulary.

The local business chamber, when it is in the confidence of the public, can be an excellent medium for making utility problems intelligible to those who know no economics, but have faith in the hard-headed business men of the community.

New uses and new loads

ALMOST everything the electrochemist does and strives to do represents added load for the electrical industry. For that reason two trends in that field will bear watching. First is the desire to consolidate two processes which in the past have been distinct. Electrolytic extraction of metals or any other method of getting copper, zinc, cadmium, chromium, etc., from ore has been independent of the later deposition of those metals in the plating operation. Progress is being made toward combining those processes into one. Every bit of that progress in so far as electro-winning replaces non-electrical methods of extraction means more kilowatt-hours. Incidentally it looks as if it would give zinc plating a chance to compete with hot dip galvanizing. If that happens it may remove the embrittlement problem without introducing others nearly as serious.

Off in another direction is the advance being made steadily in the organic branch of electrochemistry. Electrodeposition of rubber is well known and other organic and non-metallic substances are yielding to the process. A new and hopeful line of research has revealed that some 200 aromatic organic acids have the property of rendering soluble in water inorganic substances that are otherwise practically insoluble in water. This puts them into the electrolyte class and thus accelerates their subjection to electrodeposition or other chemical transformation through the electrical agency.

Electrochemistry is forging ahead. Its future rests not only in increased volume of its present products but in the opening of new areas of technique. Even in such fringe activities as the electric pasteurization of milk there are large magnitude loads involved. The process requires some 20 kilowatt-hours per ton. The United States produces and consumes 100,000,000 tons of milk per year. That is 25 per cent more tonnage than the whole world production of steel. Even one alternating-current kilowatt-hour per ton devoted to as much of the total as is pasteurized would mean an annual usage as big as that of a city with a population of 200,000.

Electrochemistry in all its ramifications warrants continuous observation by power sales promotion departments.

Let's quit squabbling

BEFORE the whole electrical industry lies the one problem of getting more people to use more electricity. By no means is this exclusively a utility problem. It concerns vitally the manufacturers, sellers and installers of electrical equipment and facilities as well. What is needed is understanding of each other's points of view on the common problems. Such understanding can come only from candid and open discussion.

We should like to see every general and committee meeting of all associations in the electrical industry open to any individual in the industry who cares to attend them. More than that, if any committee or group meets to discuss matters affecting any other branch of the industry particular pains should be taken to see that representatives of that other branch are invited to attend. For instance, representatives of contractors should be invited to attend every meeting of the home wiring committee of the N.E.L.A. and dealers should be asked to meetings of the merchandising committees.

It is recognized that in the existing state of affairs such representations would be almost sure to slow up committee work. But when the work of a committee was finished it would be an industry expression to a much greater degree than is possible now. And industry expressions are what are needed, expressions of agreement that the common problem of getting more people to use more electricity can be and will be attacked by the united front of the whole industry.

Status of "Middle West Utilities"

Report of receivers to Judge Lindley surveys financial and operating conditions of Middle West Utilities. Complete audit under way.

IN RESPONSE to the widespread interest in the results of the operations of the Middle West Utilities Companies and for the information of security holders and the public generally, the receivers of the Middle West Utilities Company have prepared a preliminary statement showing combined operating results before retirement charges and dividend requirements of the 76 subsidiary operating companies comprising the Middle West System for the eleven-month period ended November 30, 1932, as compared with 1931.

Excluded from this statement are earnings of the National Electric Power Company, the United Public Service Company and subsidiaries and non-operating companies of the Middle West Utilities group, as well as income from intercompany security holdings and profit on the sale of securities. Total operating revenues for the eleven months ended November 30, 1932, amounted to $67,206,066. This represents a decrease of $7,845,198, or 10.45 per cent, compared with same period in 1931.

An analysis of the operating revenues for the first eleven months of 1932 indicates that more than 75 per cent of the revenue is electric, with ice accounting for 11.19 per cent of the total. This is summarized as follows:

Source	Eleven Months to November 30, 1932	Per Cent of Total	Per Cent of Decrease from 1931
Electric	$50,958,300	75.82	7.28
Gas	4,524,855	6.73	11.76
Railway and bus	1,576,069	2.35	29.53
Ice	7,517,812	11.19	25.27
Miscellaneous (including water)	2,629,030	3.91	1.41
Total	$67,206,066	100.00	10.45

Operating expenses of these subsidiaries for the eleven months ended November 30, 1932, were reduced to $36,069,289 from $41,928,181 for the same period in 1931. This reduction in operating expenses of $5,858,891, or 13.97 per cent, offset 75 per cent of the decline in gross for the period under consideration.

After crediting indirect charges to construction and including non-operating income, the gross income available for interest charges for the eleven months ended November 30, 1932, amounted to $32,036,449, as compared with $35,898,269 for 1931—a reduction of $3,861,820, or 10.76 per cent.

After deducting interest requirements, amortization, rentals, etc., the balance available for retirement charges and dividend requirements of subsidiaries amounted, for the eleven months ended November 30, 1932, to $15,382,091, as compared to $20,078,603 for the corresponding period in 1931, a decrease of $4,696,511, or 23.48 per cent.

It should be emphasized that while the foregoing figures are those reported by the various companies, they do not reflect accounting adjustments which were made subsequent to November 30, 1932, and which will aggregate millions of dollars. These adjustments, made in part against 1932 earnings and in part against accumulated surplus, include:

1. Large amounts for retired and abandoned property not heretofore written off.
2. The elimination of intangible values.
3. The elimination of capital profits on the sale of properties or assets between affiliated companies.
4. The adjustment of bond and capital discount on refunded issues.
5. Reduction in the book values of depreciated investments, loans to employees, accounts and notes receivable, etc.

Furthermore, the eleven months earnings statement ended November 30, 1932, does not reflect increases in reserves for depreciation, taxes, etc., which have been authorized by the receivers.

All of the above adjustments and write-offs will affect materially the net earnings to be shown for the year 1932.

Despite the strenuous efforts to preserve intact all of the properties which formerly comprised the Middle West Utilities group, as it was constituted on April 14, 1932, some of the companies have been unable to meet their obligations to creditors and the properties have been transferred to separate jurisdictions which have appointed separate receivers. Included in this category of companies which in 1932 were eliminated from the receivers' direct responsibility and which are not included in the above earnings statement are subsidiary holding companies in which the Middle West Utilities Company has a book investment aggregating over $98,000,000, as follows:

National Electric Power group	$40,077,000
Mississippi Valley Utilities Investment Company	36,946,000
United Public Service Company	12,760,000
Commonwealth Light & Power Company	7,184,000
Inland Power & Light Corporation	1,284,000
Total	$98,251,000

The interests of Middle West Utilities Company and its subsidiaries in the Southwest Dairy Products Company were sold in November, 1932, for $200,000 cash. Other offers for some of the smaller operating properties have been received from time to time, but in general no negotiations have been entered into which contemplated the disposal of any major assets.

Costs of administration reduced

The primary objective of the receivers has been, through efficient management and unified direction, to continue as going concerns the various operating and

other companies comprising the Middle West Utilities System. At the outset, and throughout the period of their administration, it has been obvious that with constantly decreasing earnings in utility companies of every class it was imperative immediately and continuously to effect drastic economies in the operating expenses of each unit in the system, and in addition to introduce a stringent control of capital and all other expenditures.

Substantial progress has been made both in the central organization in Chicago and in the respective operating companies, and as a result of economies already put into effect the constituent companies of Middle West Utilities System are continuing to improve their individual positions and in a large measure to offset, through operating savings, the constant reduction in gross income.

Results at December 1, 1932, may be summarized as follows:

Reduction, since January 1, 1932, in the administration expenses of the Chicago office of	$1,700,000 annually
Reduction, since January 1, 1932, in expenses of operating companies at the rate of	8,000,000 annually

There has been a material reduction in the personnel of all companies, with the result that the November, 1932, payroll expense of the operating subsidiary companies amounted to only 18.2 per cent of operating revenues, the lowest ratio in the history of these companies.

At the same time there has been a substantial reduction in bank loans and other floating indebtedness of subsidiary companies and a considerable improvement in their cash position.

Results at December 1, 1932, may be summarized as follows:

Reduction, since March 31, 1932, in bank loans and other floating indebtedness of subsidiary companies of over	$5,000,000
Improvement, since March 31, 1932, in the cash position of operating subsidiaries by	2,990,000
Total improvement in liquidity of subsidaries, approximately	8,000,000

In order to rehabilitate the physical properties of the operating companies, to add substantially to depreciation reserves and to put these companies in as strong a financial position as possible, it has been necessary for the Middle West Utilities Company to discontinue to a large extent dividends on the common and preferred stocks of many operating companies, which heretofore constituted the chief sources of income to the holding company owner. This has seriously curtailed the income of the receivers, but has been constantly adhered to as sound policy.

While the bank loans and floating indebtedness of the various subsidiary companies have been reduced to a comparatively moderate total, the payment of interest on the bank loans of Middle West Utilities Company has presented a difficult problem. These loans, aggregating over $27,000,000, require annual interest payments of approximately $1,400,000. However, all interest on these bank loans has been paid promptly.

The statement of receipts and disbursements shows cash receipts of the receivers for the period from April 15 to December 31, 1932, to have been $2,067,964.77 and cash disbursements $1,740,564.46. Despite the serious drop in the income available to the receivers of Middle West Utilities Company, the income and expense statement for the period April 15 to December 31, 1932, shows that after meeting interest payments aggregating approximately $950,000 to banks and secured creditors, and after paying all administrative and departmental expenses there was a net surplus of income for the period of $288,912.47, all of which is represented by cash to the credit of the receivers. To this should be added a gain, as a result of capital transactions, of $38,487.84, or total of $327,400.31 improvement in cash position of the receivers at December 31, 1932, over April 15, 1932.

Changed organization at headquarters

In the interests of more centralized operation, the board of directors of Middle West Utilities Company has been reconstituted under the direction of the receivers and is composed chiefly of the executive heads of leading operating companies. The receivers themselves have gone on the boards of the more important operating companies, attending meetings regularly and devoting themselves to major problems of operation and policy.

From the outset, the receivers have been in constant touch with the operating heads of the subsidiaries. In order to discuss mutual problems, the chief operating executives of all subsidiaries were assembled in Chicago in December, 1932, for a two-day joint meeting with the receivers and their staff. Several important policies were adopted, including a decision that as a measure of economy all budgets for new construction would be held in abeyance for at least ninety days.

A widespread demand for lower rates throughout practically all parts of the territory served by Middle West Utilities Company has caused the receivers serious concern, threatening, as it does, the already greatly reduced earning power of the majority of the operating companies. Wherever demand for lower rates is directed against any of the companies, the receivers' policy has been to obtain the facts and assist the companies in making the most equitable and favorable presentation of their case in person to the proper authorities.

Strict financial control has been established in Chicago of the different subsidiaries. New construction and operating budgets are required to be submitted in advance and all work orders must receive the approval of the receivers themselves. This control also extends to dividend payments, subscriptions, donations and any sizable expenditures.

All parts of the Middle West System have been subjected to the constant pressure of increased taxes. This bears heavily upon the operating companies, which in 1931 paid total taxes of more than $6,000,000, or 7 per cent of these companies' gross operating revenues, while 1932 taxes were higher. The receivers have actively resisted, through the operating executives, increases in taxes and, wherever possible, have striven to obtain reductions to more equitable levels.

All insurance policies have been reviewed to determine whether coverage is adequate, and where it was obvious that insurance exceeded the revised values of the properties reductions have been effected.

For the joint benefit of the operating subsidiaries of the Middle West System the receivers have established a small but highly competent and experienced central management organization at Chicago. Included in this

staff, which works under the constant supervision of the receivers, are:

1. A supervising purchasing agent who negotiates master purchasing agreements under which each operating company makes its own purchases, but at much lower costs, made possible through quantity purchases of materials and supplies. It is estimated that the direct cash savings to the subsidiary companies, either through participation in holding company contracts, purchasing agreements, or blanket orders, will amount to $500,000 during 1933.

2. Engineers who make a critical examination from an engineering standpoint of all work orders to make certain that improvements and extensions are made at the lowest cost and in accordance with the most approved engineering practice. This group examines the operating reports of each company, making comparisons of production costs and detecting unfavorable trends as early as possible. A clearing house of ideas is maintained whereby each company receives the benefit of the improvements developed by the others.

3. A commercial and new-business manager who supervises these activities for each of the operating subsidiaries and who lends his efforts to developing in the field not only merchandising campaigns to home users of electricity but furthering efforts to increasing the commercial load.

4. Rate experts who are available at any time to subsidiary companies for careful investigation of rate questions as they arise. Successful resistance to the efforts directed toward the companies for unreasonable reduction in rates will be one of the most important factors in determining the earning power of the operating companies during the next few years.

5. Statisticians who develop information on the basis of which it has been the policy to stimulate competitive activity among the subsidiary companies in operating efficiency and reduction in costs. Results obtained from such statistical studies in operating ratios, payroll, production costs, etc., have been most gratifying.

Basis for management charge

To meet the cost of maintaining facilities similar to the above for the mutual benefit of the subsidiary operating companies and to defray also the cost of the executive and policy direction which is being supplied to the subsidiaries in connection with a great variety of their problems, it has been necessary to make, temporarily, some management charge to the operating subsidiaries. The charges made these companies are exceedingly moderate, being only three-quarters of 1 per cent of the gross earnings on the electric, gas and ice revenues.

This management charge is justified on the ground that for the great majority of the operating subsidiaries the amounts paid by them as management fees are less than the actual savings they realize from the use of the joint facilities maintained by the central management organization. One outstanding illustration of this is the substantial saving effected by the subsidiaries through the Bureau of Safety and Insurance Trust Fund, a centralization of all insurance matters which is provided in the Chicago office; this saving for all participating companies amounts to about $470,000 annually.

In conclusion, the receivers believe it is obvious that, with gross earnings still declining in most parts of the territory, no comprehensive financial readjustment of Middle West Utilities Company can be undertaken at this time and that stabilization of earnings and an improvement of the market for new capital funds must be awaited before any permanent reorganization can be effected. In the meantime, the receivers are chiefly concerned with management problems and the curtailment of expenses to offset the continuing reduction in gross earnings. They also contemplate a reduction in book values in many of the companies through a reappraisal of their physical properties and a readjustment of balance sheet items in order that their true asset value and normal earning power may be reflected.

Installing Conduit Where Excavation Is Objectionable

Another tool has been added to those available to construction men which makes it possible to avoid tunneling when underground conduits must be installed under railroad track, buildings, newly surfaced or heavily traveled roads and where breaking the surface of roads or lawns is prohibited. It is not a universal-use machine, as it cannot be employed under city streets where there is danger of striking conduits or previous trenching operations. When soft rock or shale is encountered the

Boring hole under railroad track for conduit crossing

cutters will go through, it is reported, and when small stones are met they are shaken loose into the bore and the boring proceeds. If a boulder is encountered it is either avoided by another boring or is removed by excavation.

An example of its utility under such conditions is related by A. E. Englebridge, field engineer for one of the large western utility companies:

"A certain small Western town had asked for a survey and estimate for a complete piping installation. On three successive years the bid had been returned marked 'Not for this year.'

"In the meantime, the town had laid permanent pavements, so that when the approval finally came through the engineer found himself up against the proposition of finding a way to do the work within the original estimate made when streets were unpaved.

"This resulted in the designing of a machine which was later patented and called the "hydrauger.' It was not the perfected machine of today, but it did the work so successfully that the first official comment received

was a note from headquarters pointing out that the estimate of cost was 150 per cent higher than the actual cost of doing the work."

Two sizes of machines are now produced. With the smaller machine the diameter of the hole bored by the pilot-bit is 2½ in. The use of separate reamers (4 in. or 5 in.) permits the installation of larger conduit. With the larger machine the diameter of the hole bored by the pilot-bit is 5 in. Three reamers are supplied with this model—6½ in., 8½ in. and 10½ in.

As the auger part of the apparatus screws itself forward through the earth additional sections of driving shaft are inserted between the auger head and the driving air motor. Bores 40 to 60 ft. long are ordinary common practice and bores of more than 100 ft. have been successfully accomplished, it is reported.

The bit does not "sink" or deflect in its progress according to the Hydrauger Corporation, New York City. In more than 90 per cent of cases, involving bores of 40 ft., it is claimed that the auger will come out within 2 or 3 in. of the spot at which aimed. On longer runs the larger model, when working in very light soils, will drift 1 in. per 10 ft. of bore toward the right, due to the rolling action of the reamer. This can be figured and allowed for.

The boring progresses at remarkably high rates of speed. In actual operation, for instance, the smaller machine has drilled under a 45-ft. street in eighteen minutes and under a 90-ft. street in 40 minutes, including the time required to add boring bar sections, according to reports. Only two relatively small pits are necessary —one to receive the boring machine, the other at the far end of the bore.

The direction of line of bore is accurately and simply controlled. The motive end consists of an air motor, auger feed mechanism and heavy bearings for the boring bar. These are permanently mounted on a fairly light but substantial base. Fitted to the back and front ends of the base are rear and front sights which are in line with the bore, but enough above the ground level to be in the line of sight to the target rod. The target is the same fixed distance above the brass ring, which indicates the point where the boring tool must emerge, as the back and front sights are above the boring-rod center.

The pits having been dug, the machine is pinned firmly into its operating position after having been wedged up, down or sideways enough so that the back sight and front sight on the machine are in line with the target—corrected for calculated drift.

The point of the auger is a bit of substantial length which helps keep true the direction of bore. The material loosened by the auger itself is washed back by the water fed from adjustable jets at the auger which deliver water directly in the line of advance.

Behind the auger are the cutting tools and spiral which enlarge the hole bored by the auger (from 2½ in. to, say, 4 in. or from a 5-in. auger hole to say 10½ in.). The dirt loosened by the spiral is also washed away by streams of water fed from adjustable jets at this point. The boring bars or shafts are hollow to carry the water to the spiral and auger sections. When a free supply of water under suitable pressure is not available from a faucet or hydrant, a relatively small quantity of water is used and reused with the aid of a small circulating pump. "Stellite" is added to the face of the pilot-bit meeting the work. The cutters on the spiral section are heat-treated and hardened but not "Stellited."

In the majority of cases the machine pays for itself in ten or twelve borings, the company reports.

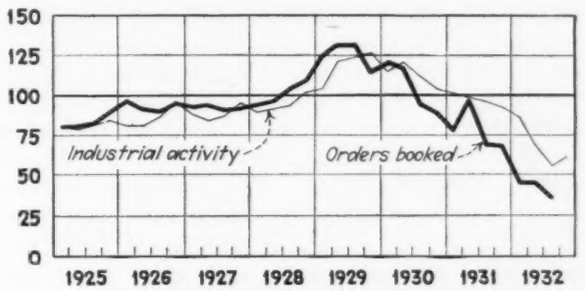
▼

Factory Activity Lags Orders by Several Months

With the close of 1932 the quarterly average of industrial activity in electrical manufacturing plants increased for the first time since the beginning of 1930. During the major part of these three years the trend had been steadily downward, following at an interval of three to six months the decrease in orders booked. This lag prevails in periods of rising as well as falling business, as is evident from the data for 1928 and 1929.

The accompanying curve of orders booked is based on dollar values as reported by the U. S. Department of Commerce, referred to the five-year quarterly average of 1926-1930 as base, and adjusted for variations in price. The adjusting factor is the wholesale price index for metal products reported by the Bureau of Labor Statistics. The curve therefore indicates relative quantities rather than relative dollar values.

The curve of industrial activity shows the quarterly average of the ELECTRICAL WORLD's monthly index for electrical manufacturing (without adjustment for number of working days) based on reported consumption of electrical energy in plants of that group. This curve has similarly been referred to the same five-year average as 100. It thus shows changes in the rate of production.



Electrical manufacturing

Orders booked—U. S. Department of Commerce. Industrial activity—ELECTRICAL WORLD, based on kilowatt-hours used.
Base: Five-year quarterly average, 1926-1930, = 100. Dollar value of orders booked adjusted for 1926 prices.

The effect of the jump in orders in the second quarter of 1931 is reflected in a delayed decline in the "activity" curve. Orders for the last quarter of 1932 have not yet been reported. The rise in manufacturing activity, despite less orders in the third quarter, may indicate anticipatory production or prompt response to fourth-quarter orders not yet reported.

Unfortunately for purposes of prediction the index of manufacturing activity, rather than statistics of orders, is the earlier figure to be available, the former being published monthly in the ELECTRICAL WORLD, whereas the Department of Commerce figures do not appear until about six weeks after the close of each quarter.

System Performance Tested With 600 Short Circuits

By E. G. RALSTON* and E. H. KLEMMER†

Opportunities are not frequent for extensive and exhaustive field tests on electricity supply systems without the necessity for taking into account a host of limiting and qualifying conditions. With the completion of Harding Street station, and of the transmission and substation facilities associated with it, the system of the Indianapolis Power & Light Company offered a test opportunity singularly free from such conditions.

The generator, transmission and substation elements of this system are new, are of mutually contemporary design and construction and therefore, more than is usually the case, constitute a closely co-ordinated and coherent whole, perhaps as near the ideal for field test purposes as it is possible to get. Appreciating the significance thus inhering in the more than 600 tests on relay and circuit breaker performance made on the Indianapolis system "Electrical World" is happy to present them.

Other articles dealing with these Indianapolis tests will appear in the February and March issues of the "Electric Journal."

ON JANUARY 25, 1932, a 13.2-kv. pothead failed on the system of the Indianapolis Power & Light Company. The new Harding Street station of the company, with one unit running at about 70 per cent load (24,000 kw.), dropped out as a result of this failure. No violent disturbance took place and the load was nicely picked up by other plants in the system and by an interconnection tie until additional generator capacity could be connected to the load. The Harding Street unit was dropped by generator differential relay action without a hitch on either the electrical or steam end. The station auxiliaries were automatically transferred to the station service transformer bank by a voltage chaser scheme without the loss of a single motor. Throughout the system all synchronous apparatus remained in step and the fault was barely noticed on the low-voltage network. No perceptible surging of synchronizing power was noticeable and the disturbance was over before the station operator could get out of his chair. Several other system faults occurring in service have likewise demonstrated the reliability of the system.

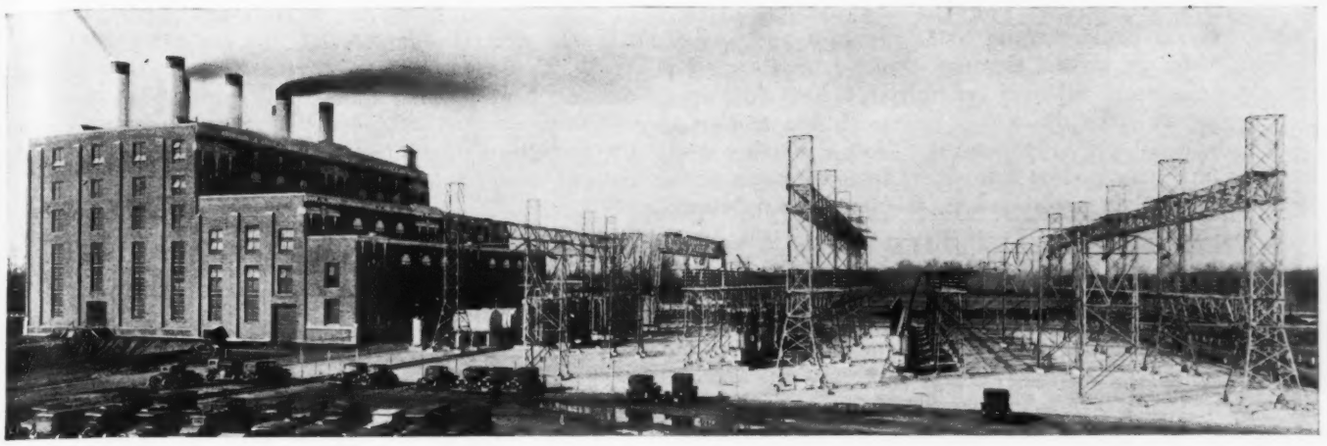
This perfect performance of relays and other protective devices could have been confidently predicted from the results of field tests on the system made in November, 1931, immediately before the Harding Street station and the new transmission and substation construction contemporary with it were placed in regular service. The system is shown in Fig. 1. The tests were made for assurance of the integrity of design and equipment in these newer elements of the system. Testing under actual fault conditions, while most effective, has been decidedly limited in the past due to the large amount of circuit breaker servicing required. This new installation throughout is equipped with "Deïon grid" oil circuit breakers. Due to this advance in the arc-interrupting art it was feasible to carry on an extensive testing program under actual fault conditions without seriously considering the effect on the circuit breakers.

Of the staged tests the most impressive were made with the entire capacity of the Indianapolis Power & Light Company, the Indiana Electric Corporation and the Union Gas & Electric Company of Cincinnati tied together carrying normal loads. These faults were placed on the 13.2-kv., 08 line at Harding Street (see Fig. 1). A total of twelve heavy capacity short circuits were made at this point involving phase-to-ground, phase-to-phase and three-phase faults. These faults were cleared within 11 cycles, which includes protective relay, auxiliary trip relay and breaker time. All generating units as well as other synchronous apparatus stayed in step, with no perceptible oscillation. Oscillographic records obtained on the two rotary converters at substation No. 7, fed off the Kentucky Avenue 4-kv. bus, showed only a period of oscillation of 20 cycles for the three-phase faults and that the oscillations were effectively damped in one second. This low period of oscillation shows that the swing was small and the synchronizing power pulling them back in step was high.

Interrupting time cut two-thirds

The breakers, although nominally rated at 12 cycles, showed under tests 9 cycles operation for the heavy faults and within 10 cycles for the minimum capacity faults, which represented only 12 per cent of the breaker rupturing rating. Subsequent tests also showed that this breaker time can be reduced an additional 1¼ cycles simply by using a faster trip coil. This breaker opening time represents about a three-to-one reduction over that obtainable with previous breaker designs. The breakers here involved have the regular tripping mechanism, so that the saving represents largely a reduction in arcing time. Consequently, the breakers were well able to stand repeated short circuit without servicing. During the light capacity tests as many as 30 shots were made without even as much as an oil check and approxi-

*Operating vice-president Indianapolis Power & Light Company,
†Westinghouse Electric & Manufacturing Company.



Harding Street plant

mately 60 shots without inspecting the contacts. Even then no perceptible reduction in the oil dielectric strength was noted and the contacts were found in good condition ready for additional service.

High-speed balanced protection

The parallel lines between Harding Street, Southwest substation and Northwest substation are protected by type "HD" and "HR" balanced current relays which operate in ½ to 3 cycles for unbalanced line currents. Various types of faults were applied at the line terminals. These end faults represent the longest clearing time as the two ends cannot trip simultaneously, since no unbalance occurs at the far end until after the near end breaker has cleared. Yet under these tests an over-all clearing time from 19 to 22 cycles was obtained with sequence tripping. This represents approximately a two-thirds saving in clearing time over that which would have been obtained with induction type relays and the former "slow-speed" circuit breakers.

For faults in the mid-section of a line the clearing time will be approximately half, as both ends trip simultaneously. Somewhat faster clearing will also be obtained under maximum capacity operation. The high-speed balanced relays afford both short-circuit and ground-fault protection during parallel line operation. Protection during possible single-line operation is afforded by induction type "CO" and "CR" relays. These relays also offer parallel line protection in case of similar faults occurring on both lines simultaneously.

Short lines create relaying problem

The single-line portions of the transmission loop present a difficult relay problem as the lines are so short for this voltage that but little difference in current and voltage are obtained between faults in one line section and the next. In effect, the transmission system is substantially a bus as far as per cent voltage drop in the lines is concerned. With minimum connected generating capacity the voltage drop in some line sections with a fault at the end of the section is scarcely 5 per cent. High-speed type "HZ" balanced beam distance relays are used for phase-to-phase fault protection. The relays are energized by 300/5-amp. bushing current transformers and 132,000/110-volt condenser bushing potential devices.

The early tests demonstrated that in spite of the low

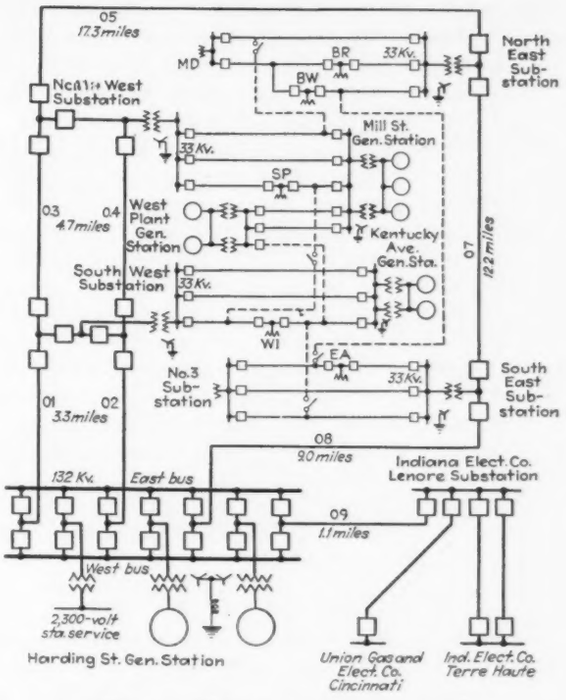


Fig. 1—This is the system tested

Indianapolis is served by a 132,000-volt transmission ring from which energy is taken at the four approximate corners of the city through 30,000-kva. (ultimately 60,000-kva.) step-down substations. Each of these stations feeds into the original 33-kv. transmission system, which has been split into four systems operating normally independently, but provided with emergency 33-kv. ties for parallel operation. These 33,000-volt systems in turn feed the 4,000-volt primary network. The power for this 132,000-volt system is supplied by the new Harding Street generating station. The initial installation is 87,500 kva. in two units. It will ultimately be extended to four units totaling 175,000 kva. The ultimate installation will include the completion of the double-circuit transmission ring with two step-down transformer banks at each high-tension substation.

voltage prevailing during the faults this combination of "HZ" relays, bushing current transformers and bushing potential devices measured the fault distance generally within 5 per cent. This was irrespective of the type fault, whether three-phase, phase-to-phase or double phase-to-ground. This feature is obtained by supplying delta current to the relays from a set of 5/5-amp. auxiliary current transformers. The delta-connected current transformers also insure that load current will not affect the fault distance measurement. After these checks on

the distance measurement the first or instantaneous element was set to operate up to 85 per cent of the line length, while the second element (which trips through a synchronous timer adjusted generally for 20 cycles) was set to operate over the entire length of line and to a point about 40 per cent beyond. Relay, breaker and clearing time obtained on subsequent tests with minimum connected capacity are shown in tabulated form below:

Clearing Time on Single-Line Portion of Transmission Loop

For a Near End Fault

	Cycles
"HZ" first element	3- 8
Near breaker time	8-10
Near breaker clears	11-18

For a Far End Fault

"HZ" second element and timer	23-27
Far breaker time	8-10
Far breaker clears	31-37

In general, faults near the end of a line were cleared from both ends in 35 cycles. Faults in the middle portion of a line would be cleared from both ends of the line by the first elements and consequently 15 cycles clearing time may generally be expected. These tests included both solid and arcing faults. The arcing faults showed no appreciable lengthening in the relay and fault clearing time.

High-speed ground relays of the distance type suitable for the service demanded on the single-line sections of the transmission loop have not been developed. Consequently on these sections the relays are timed progressively higher toward Harding Street. The first section at each end of the loop have high-speed type "HR" ground relays, the remaining sections have inverse-time type "CR" and "CO" ground relays. Therefore, ground faults on these sections will not be cleared as rapidly as three-phase and phase-to-phase faults. This is permissible as ground faults do not present the severe stability problem occasioned by three-phase and phase-to-phase faults.

Pilot protection on one-mile tie

The Lenore tie line is provided with balanced current pilot wire protection. The scheme is fed by 200/5-amp. bushing current transformers through modified type "CD" relays and auxiliary insulating current transformers of 5/0.5-amp. ratio. These auxiliary current transformers permit circulating only a small current over the pilot wires, effectively reduce the burden imposed on the bushing current transformers, insure a close balance in the relay current in case of through line current and insulate the relays from the high-induced voltages in case of ground faults. Although the relays are regular induction type, on account of the close balance their contacts can be set for minimum travel, which gives reasonably fast clearing, within 20 cycles for three-phase or phase-to-phase faults and 30 cycles for phase-to-ground faults.

Interpreting the engineering data

The staged fault tests demonstrated that certain factors negligible in the past may have a decidedly detrimental effect when dealing with high-speed relays. For example, it was found that the Harding Street "HZ" relays would not give the consistent fault distance measurement obtainable at the substations. A point of difference in the installations is that the Harding Street potential devices are also used for synchronizing, and to simplify the synchronizing switching scheme phase *B* of the potential device secondaries was grounded rather than the neutral point. When the ground was removed from phase *B* and placed at the neutral point of these devices it was found that consistent distance measurement was obtained from the "HZ" relays. In order that the ground might be retained at the neutral point of the

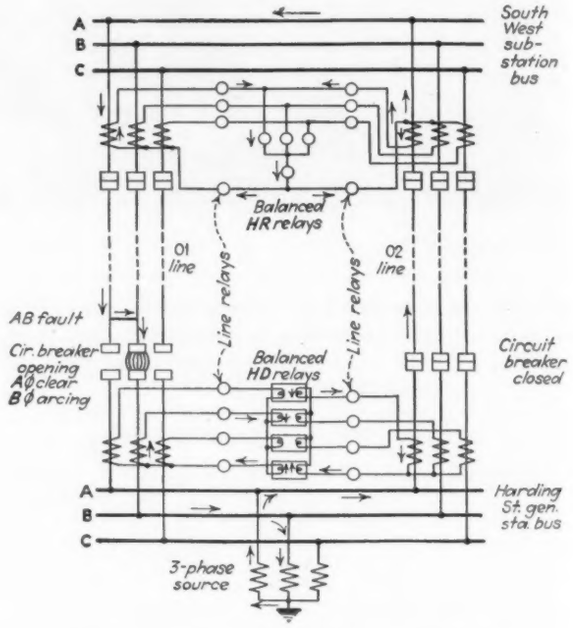


Fig. 2—When phase interruptions are not simultaneous

Unusual line currents may flow under these conditions in the short interval which may effect high-speed relay action. The simple case illustrated, demonstrated by actual test, is for an *A* to *B* short circuit on the 01 line at Harding Street, where the *A* phase cleared ¼ cycle ahead of the *B* phase. During this ¼ cycle most of the *B* phase current continued to flow directly to the fault, while the *A* phase current had to take the longer indirect paths. Most of the *A* phase current flowed over the 02 line to southwest substation and back over the 01 line to the fault, but some of it also flowed around the 132-kv. loop. For simplicity each of the phase currents is shown flowing through the preferred path only. Since the *A* and *B* phase currents do not flow in the same path their secondary currents return to the current transformers through their residual circuit. Consequently, both the phase and ground relays receive this unusual current. This, however, did not cause any unexpected relaying as the high-speed balanced relay tripping interlock for the 02 relays at Harding Street had already been opened and the type "HR" high-speed directional ground relays at Southwest did not close their directional contacts for lack of residual voltage, as there was no ground fault on the system.

If, however, the fault had been a combination phase-to-phase and ground fault it is conceivable that the Southwest 01 tor 02 breaker might have been tripped by the high-speed directional ground relay as then there would have been residual voltage to operate the directional elements of the ground relays, providing the residual current caused by the interrupting of one phase ahead of the other had the proper phase relation to the residual voltage. It is difficult to forecast what this residual-voltage residual-current phase relation might be as the residual current is not a function of the true ground current and it would shift approximately 180 deg., depending upon which of the faulty phases interrupted first. Consequently, there is about an even chance for the operation of either the 01 or 02 directional elements of the high-speed ground relays at Southwest by this unexpected current through the relays. Therefore it is questionable whether high-speed directional overcurrent ground relays should be so fast as to operate in the time interval between the interruption of various pole units of a breaker unless, of course, these relays are so interlocked that they will only respond for single phase-to-ground faults, and not combinations of phase-to-phase and ground faults.

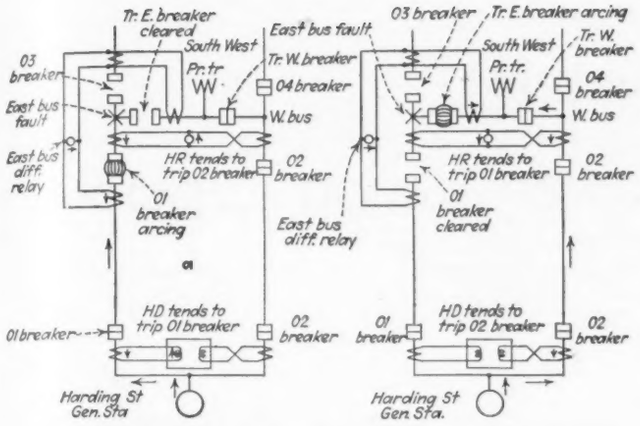


Fig. 3—If simultaneous interruptions do not follow simultaneous trippings of several breakers

In a split-bus differential scheme parallel lines which terminate on opposite bus sections may also be tripped under this condition. The illustration is for an east bus fault at Southwest substation during the interim between the clearing of the first breaker and the final clearing of the fault. Fig. 3a shows that if the bus sectionalizing breaker clears a cycle ahead of the line breaker the unbalanced line current during this cycle tends to trip the 01 line breaker at Harding Street and the 02 line breaker at the Southwest substation. Fig. 3b shows that if the line breaker clears a cycle ahead of the bus sectionalizing breaker the unbalanced line current during this cycle tends to trip the 01 line breaker at Southwest substation and the 02 line breaker at Harding Street. In either event service would be interrupted between the generating station and the substation if either breaker on the 02 line is tripped.

A remedy can be applied more readily at the substation, where the trouble originates, than at the generating station, which is miles away. Consequently, it is desirable to obtain the condition illustrated in (a) as this tends to trip the good line at the substation end. To insure obtaining this condition the bus sectionalizing breaker is tripped directly by the bus differential relays, while the line breakers, which must also open to clear the bus fault, are tripped by an interposed auxiliary tripping relay having a few cycles time delay.

The bus sectionalizing breaker auxiliary switch contact in the interlocked trip circuit to the high-speed balanced relays would prevent these relays tripping the line breakers providing the auxiliary switch operates early enough. As the regular auxiliary switch cannot be relied upon to open the interlock circuit before a high-speed breaker stops arcing an auxiliary relay is provided, for each breaker involved in the parallel operation of the lines, to open the interlocked trip circuit whenever one of these breaker trip coils is energized.

devices and also on phase *B* of the synchronizing scheme a small low-loss single-phase, 1-to-1 ratio potential transformer was interposed between the devices and the synchronizing connections.

The oscillographic records obtained during the tests demonstrated that, with high-speed relays responding in the order of a few cycles, consideration must be given to the effect produced by the unusual current flow prevailing in the system during the interval between the interruption of the first pole of a breaker and the other poles. This applies for all fault combinations involving more than one phase of the system. The first pole to interrupt on a breaker does not alter the type of fault, as in general on a system there are other paths over which the interrupted phase current may flow. The simplest case is that of a phase-to-phase fault, which is illustrated in the three-line current flow diagram (Fig. 2).

Consideration likewise must be given to the possibility that where more than one breaker is tripped simultaneously the actual arc interruption is not necessarily simultaneous even on corresponding phases. An example of this is illustrated in Fig. 3.

Besides the engineering knowledge obtained by the staged fault tests, their demonstration of the stability and reliability of the system and the satisfaction that much service trouble is eliminated due to uncovering unsuspected causes for trouble, the extensive tests have given the operating personnel a wealth of experience and familiarity with the new equipment which would not have been gained otherwise except by many years of service. As a result of these tests the system has been placed in service with unusual confidence that the equipment will perform reliably and that in case of trouble or emergency the operating staff will understand how best and most expeditiously to handle it.

Lightning in the 1932 season was exceptionally severe, causing numerous faults on the 33-kv. lines. As many as eleven faults occurred during a storm. All the 33-kv. lines are provided with "CZ" impedance relays and "CWC" and "CR" ground relays. These relays gave correct clearing of all the faults, which was most gratifying. It is also noteworthy that on each occasion the 132-kv. system rode through the storm without faults, which demonstrated the effectiveness of the overinsulation and ground-wire shielding employed on the lines and substation construction. Additional features which undoubtedly contributed to this unique performance are the use of low ground resistance in the tower footings and the installation of modern porous block autovalve lightning arresters.

▼

Cost of Headgates at Comerford Station

To close the penstock entrances at the 156,000-kva. Comerford station of the New England Power Association system two structural steel Broome self-closing headgates were installed. These gates are 19 ft. wide x 29 ft. 10½ in. high. Two 120-ton traveling headgate hoists were purchased from Philips & Davies, Inc., for handling the gates. The hoists are equipped with 30-hp., 440-volt, three-phase, 900-r.p.m. motors and have a hoisting speed of 2.3 ft. per minute, and with travel motors rated at 6 hp., travel speed 20 ft. per minute. The itemized cost of the installation, including gate guides and head frames, one set for each of the four penstocks provided in the plant, was as follows:

Labor	$4,372.78
Material	
Gates, guides and headgate hoists	66,300.00
Freight	1,681.92
Cost of erector's services	1,287.77
Rails and rail stops	721.08
Oxygen and acetylene	99.78
Coal	64.87
Board charged to job	67.15
Traveling expenses	53.08
Handling and auto operation	43.73
Miscellaneous	814.85
Total material	$71,134.23
Total cost	75,507.01
Labor painting	1,035.00
Materials, painting and miscellaneous	167.45
Grand total cost	$76,709.46
Grand total cost per kva. (cents)	49.2

Accounting and Budgeting for Power Station Operation

By C. D. ZIMMERMAN

Assistant Superintendent of Production
Ohio Edison Company, Akron, Ohio

TO SHOW detailed costs is not the primary object of an accounting system in the operation of an electricity generating station. The object is to furnish data for comparisons and for bases on which decisions can be made. Correct subdivision of costs is of special value in the case of departments not making good financial showings. A reason for continuing such departments is often the aid given other departments and the actual cost of this aid should be known by all means. Improved business methods are often the remedy for departments of this type. In one case the application of these fundamentals alone made savings of more than $30,000 a year.

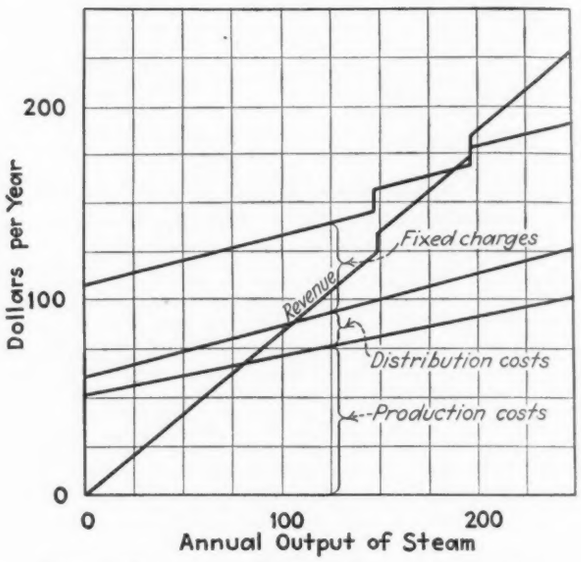
Economic studies are of frequent value in making decisions as to extensions and future courses, as a clearer "picture" is often furnished by this means than can be obtained otherwise. An example of part of such a study is shown in the accompanying graph. The greater slope of the revenue curve over that for the cost curve shows the great value of increase in output. A similar study showed the concentration of output necessary for extensions and prevented extensions not merited by the probable future growth in the given location.

A difficult problem in accounting is the allocation of costs between interlocking departments, but the problem is not insoluble. An example of such interlocking departments is the department of steam generation for sale, in which there is also electric generation for sale and the department of main electric generation. In the first case, there would be no electric generation without steam sale, so the plant is primarily a steam plant, with electric generation as a by-product, for which a credit to the steam sales department should be made at the rate of the increment cost of other electric generation transmitted to the same load point. The management of the steam sales department uses this figure in determining the true financial situation of this department.

The actual cost of this by-product electric generation, consisting of labor, maintenance, a proper part of the coal, etc., should also be shown on the accounting report as the constant improvement in design results in a decreasing increment cost for main generation, so that when this cost (delivered basis) is below the cost of by-product electric generation this generation should cease as it is also seldom needed as standby power.

Cost studies and budgets

Budget or estimate systems may serve either as one of the best means of keeping costs, exclusive of fuel, at a minimum or, if improperly used, may actually be the cause of increasing costs over what they would be without a budget. Budgets are used for two purposes: (1) To estimate next year's costs as an aid to financing and (2) to serve as a tool in cost reduction work.



Cost study shows wisdom of system extension

For the first purpose the estimate should be a little high so as to be on the safe side. If this requirement only is considered, the result on operating costs may be a material increase because the knowledge by the superintendents concerned that they can easily beat the costs charged to their departments is not conducive to good economy. This has often led to expenditures that operators felt were authorized, but which would not have been made without the countenance of the budget. For the second purpose the budget should be the minimum possible and should be made out after careful study by both the manager and plant superintendents, because many superintendents, if permitted to make this budget alone, will make sure that the year to come will not be made too hard. The actual saving from this application of common sense in budget making is surprising in amount and in its ease of accomplishment. The game of keeping this year's costs below or equal to the bogey appeals to the superintendents in charge and minimum costs result. These two bases of budgets obviously conflict and it is the duty of management to reconcile them.

If subsequent performance shows budget estimates to be impossible of accomplishment, blanket orders should not be issued to run over them. This will result in increased fuel and maintenance costs due to run-down equipment. Proper budget detail is essential and fifteen to twenty subdivisions are suggested. Curves showing year to date or last twelve months as compared to the bogey are of great value.

In short, the object of accounting systems is not to show what detailed costs are, but to enable comparisons to be made leading to decisions as to the best methods or sources to use. Economic studies are of frequent value in deciding on future trends. Budget or estimate systems if improperly used are conducive to increased costs, but if properly used are an excellent means of reducing costs. To reduce costs the budget should be (1) made jointly by management and plant superintendent, (2) the lowest felt possible, (3) in essential and workable detail and (4) checked monthly, preferably by curves comparing actual with estimate.

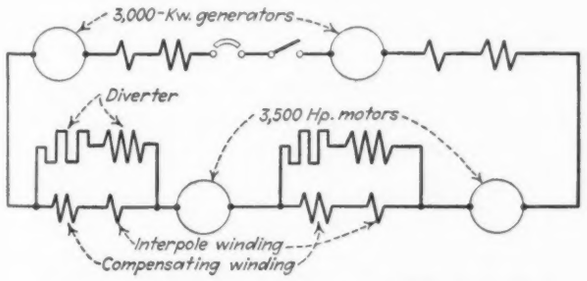
▼

Curing Bad Commutation on Roll-Drive Motors

By S. EIN
Hammond, Ind.

Obvious cures for trouble are sometimes the hardest to recognize. A case of this was a condition of bad commutation in a large Middle West steel mill. A Ward-Leonard system had been installed to drive a blooming mill. Its roll motors consisted of two 3,500-hp. machines on the same shaft and they received power from two 3,000-kw. generators, parts of an induction motor flywheel set. The connections are shown in the accompanying diagram. When the construction work had been finished the usual tests were made. Only unimportant faults appeared until the roll motors were operated with full voltage and light load. As they were started and accelerated vicious sparking occurred at the brushes. This was surprising because the motors were commutating only a small portion of their rated current.

Various remedies were tried, such as shifting the brush-holder arms and changing the values of resistance and reactance in the diverters. All failed. Finally, the



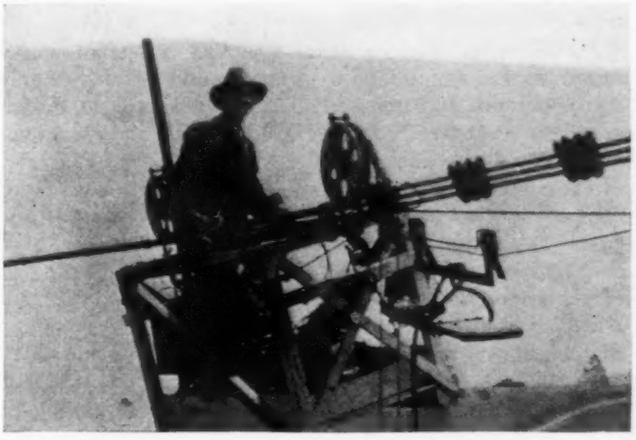
Commutation corrected by reversing interpole and compensating windings

interpole and compensating windings together were reversed in polarity on each motor and, to the satisfaction of the beholders, the sparking disappeared. As load was placed on the motors through rolling, commutation remained normal and it is in that state today. Evidently the connections chosen to get the correct polarity of the windings had been the wrong one of the only two possible.

Painting a 4,482-Ft. Span

Periodically, steel cables of the 4,482-ft., two-circuit, 110-kv. span across the Carquinez Straits at the upper end of San Francisco Bay are repainted by the Pacific Gas & Electric Company. In the past this job has always been assigned to a steeplejack as the low point on the span is 208 ft. above the waters of the bay. Recently, however, it was decided to let the line construction department do it.

To conduct the work a platform, 5 ft. long and 3 ft. wide, was suspended from the cable by two 16-in. aluminum snatchblocks. It was allowed to travel out to mid-span, retarded by means of a 2,500-ft. length of hemp rope run through a sheave at the top of the tower and attached to a hand-operated winch at the bottom of the anchor tower of the span. To keep the wind from



Cable-painting carriage suspended above Carquinez Straits

This car, two men, 125 gal. of paint and 600 hours were required to give the six 4,500-ft. cables two coats of paint, a job previously done by steeplejacks.

blowing the natural sag of this rope into conductors of the other circuit 32 small wood blocks, each attached to a 24-in. length of sash cord, were supplied. As the car traveled the rope was passed through these blocks, which were attached to the main cable at 75-ft. intervals.

Painting of the cable proceeded from mid-span toward each end. One man rode in the car and another was stationed at the base of the tower to operate the winch. Before painting the cable it was wiped and thoroughly wire-brushed. The first coat was red on a black surface, the change of color insuring complete coverage. A second coat of black paint of a good grade of graphite was then applied. Approximately 4 ft. of cable was painted before the car was moved to the next position.

Approximately 125 gal. of paint and 500 working hours were required for painting the six cables of this span, the balance of the 600 hours required for the job being expended on painting anchor towers. Only two men were required and the work was done in a highly satisfactory manner and at a saving over the previous method of letting the contract to an outside firm. That maintenance pays was indicated by the fact that when the original paint was removed in certain places for inspection the steel itself was found to be in excellent condition, although the cable had been exposed to salt air for almost 30 years.

Industrial Terminal Innovations

Twenty-ton elevators, equivalent of television for dispatching of motor trucks to particular stalls on any of the industrial floors, exclusive use of No. 4/0 conductor size for feeders, judicious use of the network principle, staggered tapping of risers, a traveling scaffold made of a discarded auto chassis and a new connector for splicing in congested junction boxes — these are just a few of the departures of an electrical nature developed in conjunction with this large-scale project.

ERECTION of a fifteen-story industrial building 800 ft. long and 200 ft. wide gives both an opportunity and a responsibility to provide the best of electrical facilities at lowest possible cost. Careful preliminary analysis, skillful design and clever execution of the task accomplished just this in the case of the Port of New York Authority's new inland freight station at Eighth-Ninth Avenues and Fifteenth-Sixteenth Streets, a solid Manhattan block. In serving the 2,500,000 sq.ft. of floor area, 1,840,000 sq.ft. of which is industrial area, the $\frac{3}{4}$- to 4-in. conduit totaled nearly 120 miles, with 763 miles of wire of various sizes drawn into them to serve 29,280 lighting outlets and whatever power may be required by the tenants.

Incidental to assuring complete adequacy and flexibility of service and comprehensive supervision of the whole installation there were many developments of a novel nature.

The basement and ground floor of the building are to be leased to the eight railroads having metropolitan rail freight terminals. Less than carload freight will be trucked by the roads between these terminals and the inland terminal. The objective of the Port Authority is to reduce street, dock and river congestion in and around Manhattan by minimizing the cross-haul of many loaded private trucks and, above all, to cut the costs of this branch of transportation. Ground space costs dictated the economy of providing thirteen additional floors for renting to industrial tenants who would wish to take advantage of the facilities for receiving raw materials and parts and for shipping assembled and finished products. The dominant electrical problem presented to the engineers of the Port Authority and the architects and contractor was to assure efficiency and flexibility of distribution facilities under any reasonable conditions of tenant occupancy or their requirements for light and power. It was imperative, therefore, that the demands and energy consumption of likely tenants be studied carefully in order to meet the probable usage of power without too much excess copper or without inadequate means of making feeder capacity adjustable to a wide range of tapping to serve any reasonable combination of branch circuits, metering or demand.

Such a study by Horace Dowie for Abbott, Merkt & Company, the architect-engineers, led to the adoption of a standard demand for 1.5 watts per square foot for combined light and power with 3.8 kw.-hr. per year per square foot as the annual consumption. The study embraced 80 loft and manufacturing buildings involving 16,000 kw. of combined demand for the 11,000,000 sq.ft. of area used by the customers. The demands actually noted ranged from 0.54 watt per square foot for a loft building to 5.4 watts for a factory. The same two types of installation provided the extremes of 1.25 and 11.50 kw.-hr. per square foot per year of energy

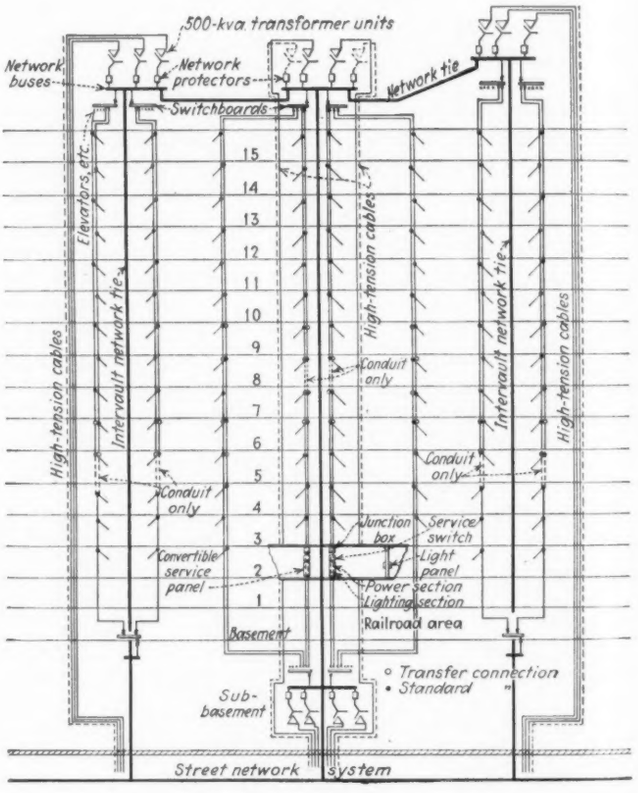


Fig. 1—Network-radial combination affords flexibility and economy

Central risers terminate at seventh-eighth floors and the end risers at fifth-sixth. A one-floor gap is left in each riser, but this can readily be closed through existing conduit; loading terminates two floors apart. Adjacent risers serve alternate floors, with dummy Goeller connectors in place at all floors to facilitate quick shifting of load, for balance purposes—(1) from one feeder to the adjacent one, (2) from both feeders at any floor, (3) from the up or the down feeder by extension. Each feeder in general serves the area toward the nearest end of the building in order to avoid crossing the several vertical expansion joints in the building structure with the initially installed conduit lines. Lateral conduit lines have been installed at four-floor intervals for the conductors necessary for demand and energy totalizing in case cross-feeds from one area to another become necessary for a single tenant. The Edison company totalizes at one point the power fed to the switchboards at six points.

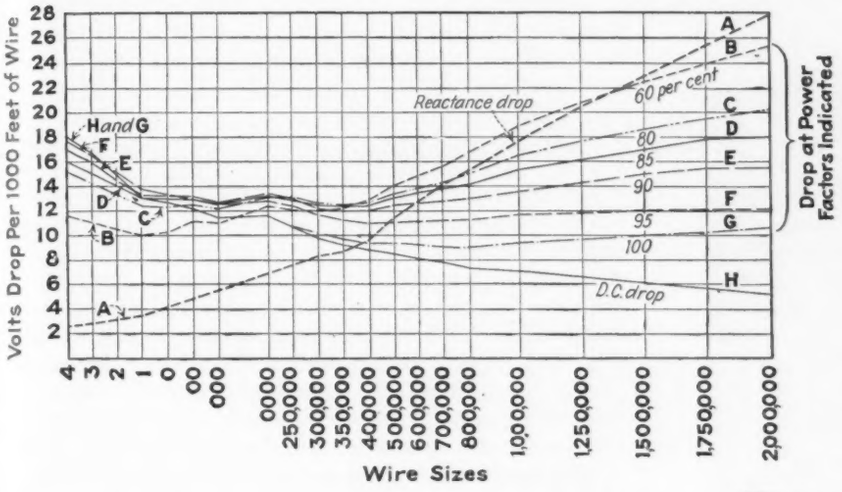


Fig. 2—Multipled No. 4/0 conductors best for heavy distribution.

Considering probable power factors in conjunction with the counter influences of resistance and inductive drops, multiple No. 4/0 conductors are better than larger sizes for large currents. Based on minimum spacing, 60 cycles and Table A current ratings of Article 612 in N.E.C.

Fig. 3—Connector solves congestion in junction box

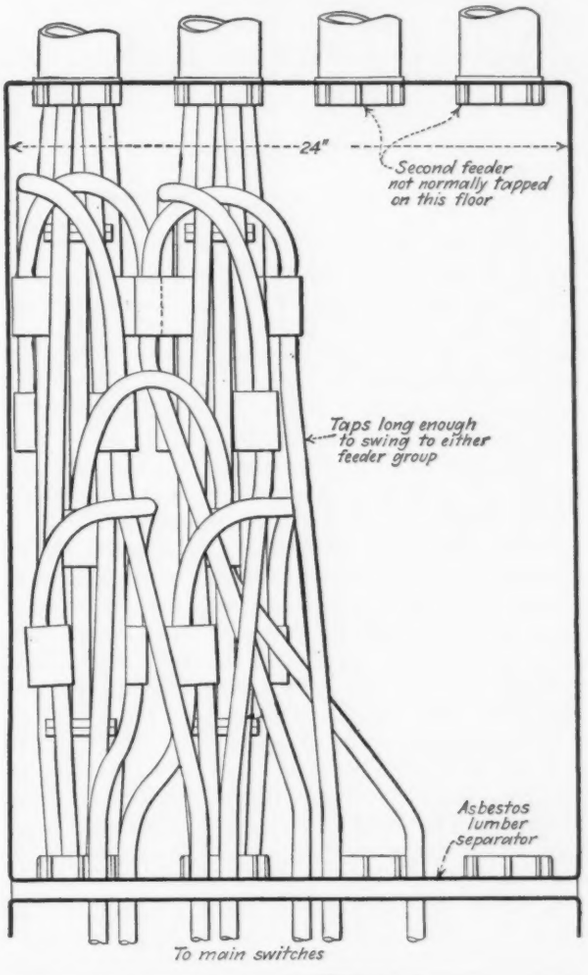
Four No. 4/0 cables properly disposed in two conduits constitute one phase of the four-wire, three-phase feeders to give best voltage regulation. Connector of Fig. 4 affords means of making the fourteen taps necessary for a three-phase branch-off in box of limited size.

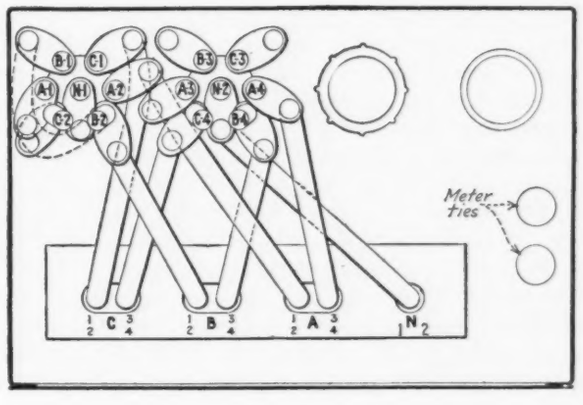
consumption. The aggregate of kilowatt-hours for the 57 samples for which energy data were authenticated was 28,000,000.

With the demand established, the next task was to provide the utility supply and the distribution within the building in such a way as to minimize the amount of copper, duct and junction-box installation. The supply consists of three groups of 13.2-kv. cables from the New York Edison system on Fifteenth Street. One vault of 2,000 kva. capacity is in basement space adjacent to space provided for possible later use as a boiler and engine room. In penthouses above the fifteenth floor are two vaults of 1,500 kva. capacity and one of 2,000 kva., which at present has only 1,000 kva. of transformers installed. The present capacity is therefore 6,000 kva., with a future possibility of 7,000 kva. Two of the high-level vaults are placed adjacent to the two groups of freight, truck and passenger elevators serving the two halves of the building.

The secondary network idea was employed extensively, nevertheless the vertical feeders and branch runs are radial. Consideration was given to adopting a four-wire, three-phase network for the local distribution, but the problems of overload protection, municipal requirements, trouble shooting and overloading of certain sections when others trip out militated against this radical departure. As it stands, the system (Fig. 1) consists of a four-wire, three-phase network bus served from four groups of 13-kv. transformers with network protection at each bank. At each vault there is a metered tap to switchboards, from which points the distribution is then radial. To serve a few floors at each end of the building there are two switchboards tapped directly off the network. A network run along the Fifteenth street side of the building in conjunction with the tie risers and the horizontal intervault ties really amounts to moving into the building a portion of the Edison company network that would be in the streets if the same load were to be delivered to a multiplicity of independent buildings in a compact area.

In adopting the conductor size for the risers careful analysis was made of the voltage drop with multiple-conductor phase legs as against larger single conductors of requisite cross-section. The recent A.I.E.E. paper at the Baltimore meeting by Messrs. H. R. Searing and E. R. Thomas of the New York Edison System discussed this thoroughly and its conclusions governed the installation in this instance. Four No. 4/0 conductors


24"
Second feeder not normally tapped on this floor
Taps long enough to swing to either feeder group
Asbestos lumber separator
To main switches



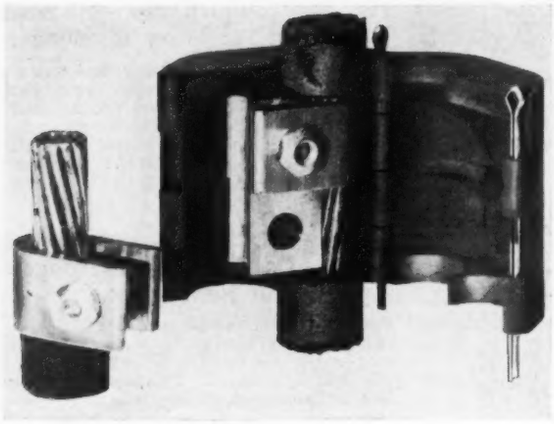
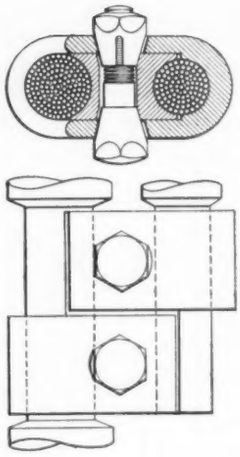


Fig. 4—Connector presents novel features

Taper on nut and bolt-head provides powerful grip on cables. Few parts, simple assembly, adaptable to wide range of wire size by change of groove and U-strap diameters. Bakelite hinged cover eliminates all need for tape and compound.



for each phase disposed properly in two adjacent conduits along with the two neutrals, one in each duct, give the best all-round performance from the standpoint of voltage regulation at varying power factor. Allan Coggeshall, president of Hatzel & Buehler, Inc., the electrical contractors, made an independent study and arrived at the same conclusions. His approach is presented in Fig. 2.

In order, however, to derive the indicated results it is necessary to establish and maintain fixed relative locations of the wires which constitute the group of conductors needed to afford the requisite ampere capacity for each phase leg of the feeder circuit. These locations are indicated in the plan view of Fig. 3. A specially designed thimble made it easy to pull the cables in so that they would assume these positions throughout the length of conduit (generally only one floor height). Finally, in order to insure the balance of currents in each of the four conductors of a phase it is necessary to tap all of them for any single-phase or polyphase branch-off to a distribution center.

The study of distribution already mentioned emphasized a feature of interior distribution economics which is not always recognized. Street distribution systems of utilities need have in general only a small margin of capacity above combined demands because of the influence of diversity factor. Interior wiring systems, especially to serve uncertain load characteristics, cannot, however, with even the best of design, avoid a capacity several times the combined load demands in order to meet load requirements at any spot. Putting it another way, the diversity factor aids the utility far more than it aids the building owners. The result is that the tenant and the owner carry an internal investment in distribution not far different in magnitude per kva. of connected load from that which must be carried by the part of the rate paid the utility to cover the investment in street distribution. There is here a powerful incentive to trim capacity and installation costs in building distribution, especially where the actual demands cannot be predicted with certainty. This is the case with buildings set up for mixed industrial rental.

Wide flexibility in capacity adjustments

In this job Mr. Dowie devised a distribution scheme which takes advantage of all possible opportunities to keep the capacity down near to demands. Starting with the network connection of the secondaries at the vaults, the next feature in order is the multiple conductor secondary feeder scheme which reduces the voltage drop and therefore reduces copper weight for a given permissible drop. Next in order is the decision to run two main feeders in parallel in each distribution shaft, tapping each of them only at alternate floors. An added feature is that these feeders run up from the lower level vaults and down from the upper level vaults to terminations at the seventh and eighth floors respectively. This installed capacity can therefore be rendered available to meet unfavorable load distribution either by transferring load between feeders or by tapping both feeders if necessary at any floor and also by extending feeders up or down an additional floor or two to correct any similar vertical unbalance.

Each distribution center has a three-conductor branch, consisting of neutral and two-phase wires of the four-wire, three-phase distribution running to the columns from which the lighting for the bays will be controlled. The balance between phases will be met by having the phases serve the bays cyclically in sequence. In the absence of definite knowledge as to the power requirements for any specific area the power circuits will be run in exposed conduits as required from the nearest distribution centers. Vertical feeders are of 30 per cent para, flame-resisting wires in galvanized "sherarduct."

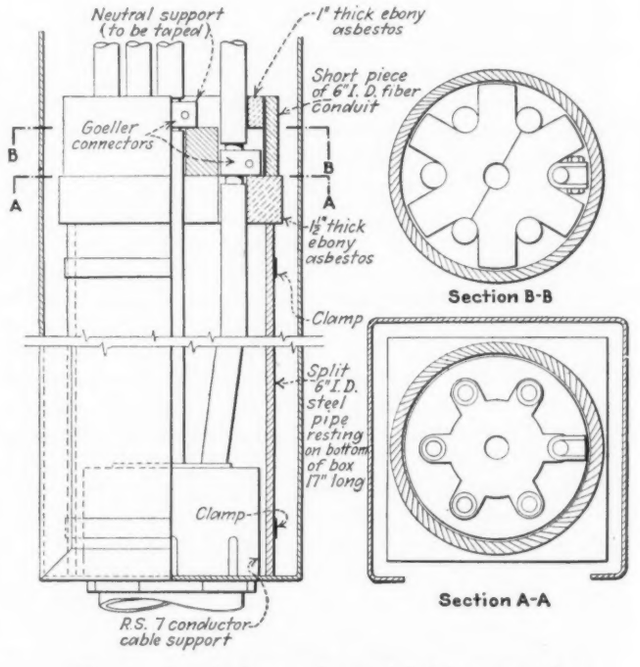


Fig. 5—Insulation and metal held separately on vertical runs

Cable support holds varnished cambric insulation and connector holds copper with star to wedge cables into symmetrical position.

Horizontal branch runs are of No. 6 with special Grade A Okonite insulation, calculated to cut the expense of wiring maintenance to a low figure. The initial cost of these branch conductors was high because they are practically of underground type of insulation, but it was felt that it was well justified because of the certain saving in subsequent maintenance.

In tapping the feeders at the junction boxes it was necessary to minimize congestion of the taps because of the necessity of tapping four conductors for each phase tap and, altogether, make fourteen splices or taps on the four-wire, three-phase feed. That this was accomplished cleverly can be seen from Fig. 3. What primarily made this compactness possible was the connector developed for this job by R. A. Goeller, vice-president of Hatzel & Buehler in charge of construction, and fabricated by Raymond Roth, Inc. In addition to meeting the space requirements this new connector has many points of merit as described in more detail in conjunction with Fig. 4.

Double suspension for cambric cables

This connector served also as a clamp to hold the weight of the copper in the long vertical runs of the intervault ties. It was found that the wedge-support acting through the varnished cambric insulation was not sufficient to prevent relative motion of the copper under tension and expansion. How this was overcome is shown in Fig. 5.

Adjacent to each junction box is a meter box which can house a maximum of six single-phase meters or a lesser number of polyphase meters with their current transformers. If power-using tenants are numerous enough to necessitate more joint light and power meters they can readily be installed in supplementary boxes adjacent to the junction boxes.

Each floor has eight convertible service panels of the Trumbull type with three-pole element fusing of each branch with capacities of 100, 200 or 400 amp. provided or possible. As previously stated, any necessary power supply for tenants will be run in exposed conduit from the terminals of the metering transformers to the desired locations in the rented bays. The lighting taps from the metering transformers return to the lower compartment of the convertible service panel and then run in floor ducts to the boxes at the columns from which lighting and appliance outlets for the bays will be controlled.

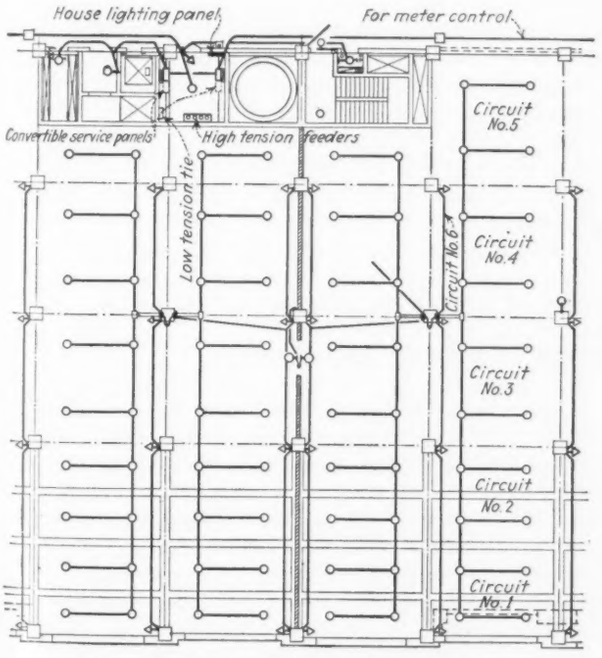


Fig. 6—Four ceiling outlets per bay

Grouping of lighting circuits facilitated layout for any likely conditions of tenancy Half the width and less than one-thirtieth of the length of one floor shown.

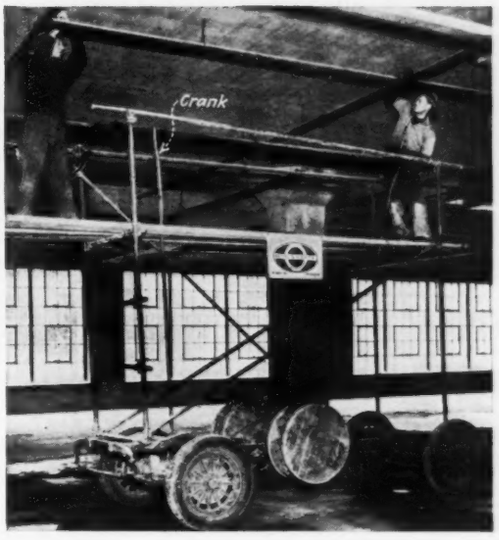


Fig. 7—Automobile chassis converted to traveling scaffold

Drive shaft and steering column turned upward for control from the deck. The framework is joined entirely by switchboard fittings and the height can be adjusted to any ceiling level in short time.

In order to simplify the installation at the columns a small junction box was set in flush so that the lighting control panel could be installed later on the surface and thus not necessitate a larger cross-section of column for the sake of having the control box flush. The two are arranged in staggered manner with knockouts that eliminate recourse to nipples between the boxes. The lower part of each of these panels has a locked compartment that prevents tenant access to the chamber where the circuits are divided for service to the different floor areas.

For lighting purposes the unit area is one group of four bays from the center line of the building to each longitudinal wall. The inner bays are 23 ft. square and those along the outer walls are 35x23 ft. Each square bay has four ceiling outlets and two appliance outlets on the column at its corner. The wiring of these outlets is in accordance with the plan of Fig. 6, so that the circuits may have combined metering and control at the distribution panel best adapted to a wide range of tenancy of the bays.

Service to each unit area is single phase, but the subfeeder to the distribution panel in each case consists of two phases and the neutral of the three-phase, four-wire system to serve the bays on either side. Phase balance is obtained by allocating consecutive bays to phases *A, B, C, A, B,* etc.

In the installation work several innovations were introduced. The large unobstructed area of the thirteen loft floors afforded one opportunity. A traveling scaffold for ceiling work was devised and it proved to be a great time saver. Discarded chassis from auto graveyards were

stripped and provided with a scaffold that provided means for propulsion and steering from the deck (Fig. 7). With this scheme it was possible for the electrician to move from bay to bay without wasting time in climbing and also saving the time of scaffold make-ready. The platform was made long enough to reach between two outlets. This perambulating scaffold attracted so much notice that Hatzel & Buehler have

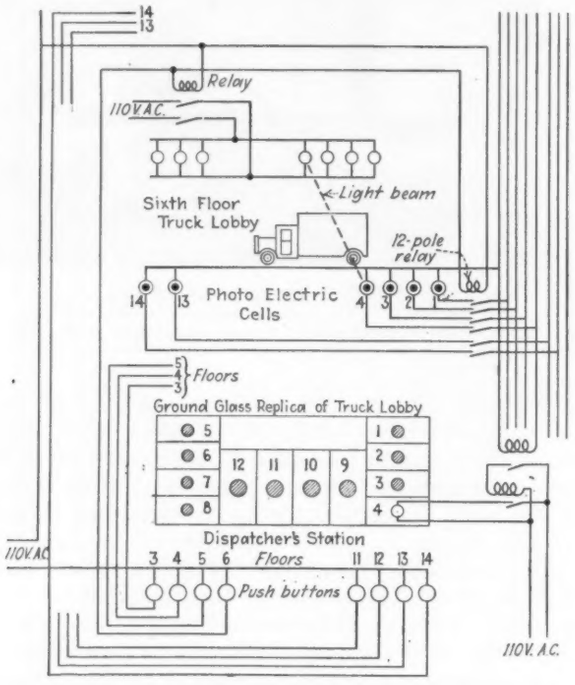


Fig. 8—Television approximated for truck dispatching

Before allowing truck to proceed by elevator to any stall in the upper floor truck lobbies the dispatcher can check the vacancy of that stall. Photo-cell sends the proper response to a ground-glass replica of the lobby showing vacant and occupied stalls.

already built several of them for other interior contractors.

As another incidental development there was suggested by J. W. Cowan of the Hatzel & Buehler staff and produced by Pexto for this job a new type of pliers with curved blades and jaws adjustable to a range of wire diameters. By setting stops between the jaws the insulation can be cut by these new pliers without damaging the conductor strands. The curved jaws also make it possible to strip the insulation from conductors in congested locations as only a small angle of swing is needed to cut the insulation all around.

Innovations in signaling

As soon as occupancy and traffic in the building increase it will be necessary to provide an efficient and comprehensive means of dispatching the empty or loaded trucks to specific stalls in either of the two truck lobbies on the thirteen rented floors adjacent to the two banks of 20-ton truck elevators. According to the scheme so far devised photo-electric cells will be used to give the dispatcher a replica of each truck lobby with its twelve stalls in such a way as to disclose on a ground glass screen the state of occupancy or vacancy of each of the stalls. The light sources and photo-eyes will be energized only as desired by the dispatcher when he learns the particular floor and stall to which a waiting truck is ready to proceed (see Fig. 8).

In order to protect the interests of the tenants as well as of the proprietor an elaborate signal system has been installed governing the watchman service and the supervision of sprinklers, guarding against intrusion and pilfering of tenant areas, loaded trucks or loading platform. The hazard from carbon monoxide and vitiated atmosphere if truck motors are left running in the truck lobbies is met by superimposing on the ventilator system an alarm system to warn of excessive fouling of the air. The patrolman is thus warned, for example, to start the fans before entering any truck lobby to shut off a motor inadvertently left running into the night.

Adjacent to the railroad area on the two ground floors is an Electric Products Company battery-charging equipment for keeping the industrial truck batteries charged for the railroads. The room provides, in addition to the motor-generator sets and control panels, charging stalls and outlets for the batteries of seven trucks.

Bulk goods for metropolitan delivery will be handled in high-speed Otis elevators of 20-ton capacity, capable of handling fully loaded trucks of large dimensions. There will be two of these large elevators near each end of each half of the 800-ft. building. Grouped around them will be six smaller 10,000-lb. elevators for shipment of package goods either by light delivery trucks or to the railroads which operate the ground floor freight station. A sixteen-story office section will constitute the Eighth Avenue frontage of the building and it will be served by eight passenger elevators, with provision for four more as the traffic increases. In addition to these elevators there will be a building service elevator and one short range lift to serve the boiler room.

One final electrical feature may be mentioned. There is a large number of roll-up doors along each longitudinal face of the building where the trucks back in to the railroad loading platforms. Each of these doors is raised and lowered by a motor controlled by a magnetic switch, main switch and push-button control arranged in compact manner alongside the door.

The architect-engineers were Abbott, Merkt & Company and the electrical contractors Hatzel & Buehler, Inc. J. C. Evans is terminal engineer for the Port Authority.

▼

Photo-Electric Ground Detector Gives Remote Indication

At the Market Street substation of the Hartford Electric Light Company provision has been made to transmit indications of a ground detector to operators at Pearl Street substation by utilizing a photo-electric cell at the former point. A small lamp shines continuously on the face of the ground detector, the indicator of which carries a black masking disk. As long as the indicating hand is in the center, showing no ground, no light is reflected back upon the photo-cell and no signal is given. The instant a ground occurs the hand moves, unmasking a mirror, which reflects a light beam upon the photo-cell, tripping a relay and furnishing the desired remote indication at Pearl Street.

Shunt or Insulate Transformers?

An impartially interested observer sees in the problem of protecting lines and apparatus against surges some fundamentally practical considerations that are being somewhat obscured by a mass of theoretical detail on the one side and economic readjustment on the other. The ruling premise is, of course, that lightning must be subdued somehow. Everything else is subordinate and contributory to that prime requirement. Lightning is an unruly citizen, anti-social in tendencies.

Now, the ordinary process of subjugation of unruly citizens involves one or more of the following methods: (1) The miscreant may be executed or otherwise exterminated; (2) he may be put outside a high wall of defense and estopped from disturbing a peace-loving community; (3) the moral fiber of society may be so strengthened that he may safely be allowed to mingle with it; (4) he may have his energies redirected into harmless activities.

The technical equivalents of all these devices are being used in electric transmission systems. The argument at the moment is about which of them to apply to transformers. By the time lightning gets to the transformer it has defied rather than succumbed to the first two methods of restraint. The question, then, is primarily a choice between the last two methods.

In other words, the problem in the last analysis becomes simply one of rendering transformer windings proof against the surges or else rendering the surges themselves innocuous to the transformer windings. The established practice of fortifying the end turns on the high-potential end of the high-voltage winding is too dubious to rely upon. The oscillatory characteristics of the highly capacitive winding have been known to lead to faults down in the winding or even well toward the grounded end. The high choking effect of the inductive component of impedance to surge is often thoroughly discounted by the counter effect of distributed admittance. End turn insulation is giving way to design of windings for the uniform distribution of stress independently of impressed waves, but even with this design there is an upper insulation limit.

Until some safe method is devised whereby a transformer may be tested and given an impulse rating corresponding with the impulse performance of the shunting air gap arrester or terminal bushing, a method of introducing into the circuit ahead of the transformer some series device to so modify the wave form of the surge that the destructive stresses between transformer turns will be minimized could well receive parallel attention. If such a surge absorber could be made immune from the disruptive effect of steep wave fronts and could function on sloping wave fronts we might be pointed along the road toward eventual safeguarding of transformer windings.

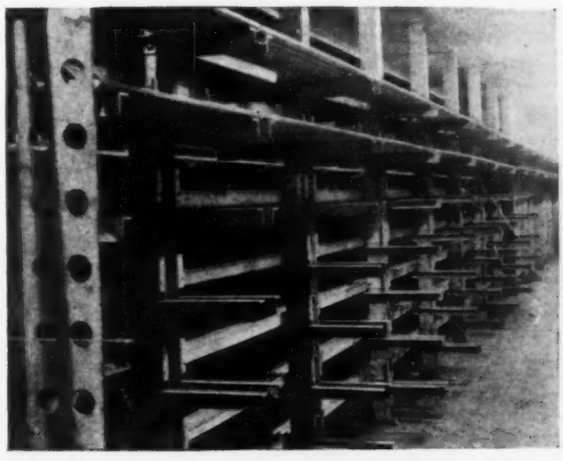
Thorough trial of that type of protection need not interfere with the development of the technique of impulse testing and impulse rating. Meanwhile some one may come forward with convincing explanation of what really happens in a winding whether it is shunted or not by a protective device. There will have to be as great certainty about the time lag and rise of voltage at any and all points in the winding under surge application as there is about the relief performance of the shunt mechanism.

By such process of reasoning it appears inescapable that the operating man will find more solace in well-placed confidence in the efficacy of the protection than in assurance that the transformer itself is designed to be proof against specific surge values. At least the cost of attaining effective protection appeals to him as substantially smaller than the cost of making the transformer itself demonstrably equal in ability to withstand lightning. He will be favorably impressed when he knows that impulse testing has been employed in design to perfect a transformer structure that will stand up under surges when effectively protected. But he will be a little cautious about stipulating that surge tests shall be imposed on the specific transformers that he buys.

There is still plenty of doubt in his mind as to the vagaries of high-frequency oscillations in the complex circuits which high-voltage transformer windings constitute. In many instances he will excusably feel that stressing by impulse may lead to a breakdown which, if it occurs in a considerable mass of solid insulation, is likely to deionize the region and for the moment prevent a follow-up discharge at power frequency. He is waiting to be convinced that such latent weaknesses will not be temperamental enough to lead to a 60-cycle failure on the next surge. That confidence will come principally through the satisfactory field performance of the transformer and its lightning protection whether or not they incorporate features learned from impulse "tests to destruction" of models in the evolution of perfected designs, or by the development of a series device which will make the surge innocuous to the windings.

▼

Compact but Accessible Control-Cable Racks



Control wiring in a large hydro-electric plant recently completed in the West is carried in lead-covered cables laid in corrugated sheet iron trays. A large number of circuits can be installed in a relatively small space, seven tiers being provided in a room of normal height. In addition to savings in investment, this design has the further advantages of accessibility and flexibility, circuits being segregated individually but instantly available for repairs or changes. Space also is provided for future additions with a minimum of investment.

Service Calls Help Customers and Develop New Business

TO FORESTALL complaints on bills and the tendency of commercial customers to curtail their use of electricity, which have become quite common due to economic conditions, the American Gas & Electric operating properties are sending lighting service men to all the commercial customers (concentrating on those using less than $10 worth of electricity a month) to demonstrate how they can use electric light most efficiently and effectively to stimulate the customer's sales. This was started primarily as a service function —to help customers visualize tangibly in terms of their own conditions how they will save or even make money (net) by better maintenance of lamps and reflecting surfaces, proper selection of equipment, wattages and lamp voltages, and that if light is used effectively it can be made a star salesman. Most of the suggestions consist of demonstrating with a kit (not merely stating) the necessity of cleaning reflectors, walls and ceilings frequently, purchasing reliable lamps of proper wattage and voltage, directing light properly and repainting (where necessary). By so doing the customers are being convinced that they should think of lighting effects, not merely kilowatt-hours.

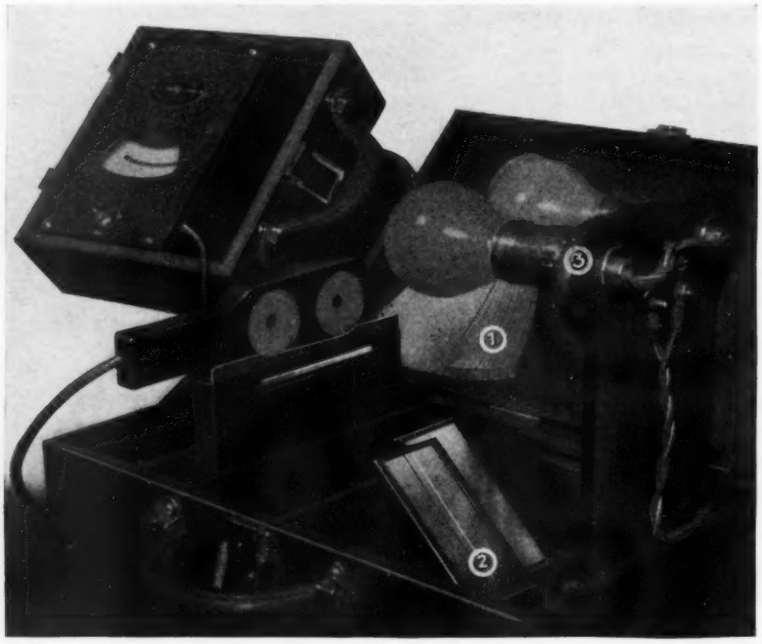
Despite the fact that the major motives of these calls have been customer service, creation of satisfaction with present bills and maintenance of present business, increased business has resulted not only to the utility but to equipment and paint manufacturers, contractors, etc. Between September 1 and December 1, 1932, nine lighting service men made 1,222 such calls; 285 customers requested complete lighting analyses; 528 kw. in added lighting was recommended (averaging 1.85 kw. per analysis) and 184 kw. was added (averaging 0.65 kw. per analysis, or 6.8 kw. per man per month).

Assuming that these results could be continued and thus bring in 81.6 kw. per man per year, and that this new load would be used 1,000 hours per year, the new annual business acquired would be 81,600 kw.-hr per man. At 5 cents a kilowatt-hour this would be $4,080 new revenue per man per year, or $36,720 for the nine men per year. Figured on a per customer basis as above, the increase in annual revenue would be $7.54 for each commercial customer in the class mentioned, or $32.20 for only those customers who agree to have analysis and recommendations made.

This is not pointed to as a selling achievement, but as a worthwhile by-product when considered as a yearly continuing revenue which is only indicative of the potentialities of customer-service approach. Especially is this work significant when it is considered that 50 to 60 per cent of this company's commercial lighting customers averages less than $10 worth of electricity per month, and yet in the aggregate commercial customers contribute 25 to 30 per cent of the total revenue of utilities as a whole.

This lighting service is organized around the use of a Weston photronic-cell lighting kit by each lighting service man who has previously been given a two-day training course, in which he is required to demonstrate how he would handle situations in which the listener is indifferent, critical or even antagonistic. Seventeen men have been so equipped and trained; eight more will be before March.

So all customers will be covered systematically, each service man is provided with a definite number of cards a week giving the customers on whom to call with data on their respective average monthly kilowatt-hours, aver-



Portable kit that brings demonstration facilities to customers' premises

Besides the photronic cells and meter that measures illumination directly in foot-candles, this lighting-service man's kit provides: (1) A collapsible reflector for demonstrating effect of bare lamps and focusing or spreading light control; (2) glass screens having the equivalent of one month's accumulation of dust; (3) sockets and different rated lamps to show effect of changes; (4) samples of wall and ceiling coverings in different colors and reflection coefficients to demonstrate absorption of light. The results of comparative demonstrations can be read in relative values directly. The set can be used to evaluate results under conditions encountered on customers' premises and to show effect of changes.

age cost per day, highest monthly bill and monthly light and power rates and billing connected load. Other data or spaces for information collected in the interview are provided on the card. Illustrations showing effect of different types of reflectors and tables showing hours that different rated equipment will operate with 1 kw.-hr., average rates for different monthly consumptions, cost of electricity for different-size lamps and motors at different average rates enable the service man to answer many questions.

On entering a customer's place of business the service man mentally compares the customer's electrical cost per day with some product the costumer sells, as it has been found that such a comparison gives the user a better conception of the low cost of his electric service. The opening remark of the service man is to emphasize that he is selling nothing and merely has some suggestions on how to use light most efficiently to increase business. Attention is called to the fact that up to 25 per cent of most light is wasted due to overlooking maintenance. The customer is given a lighting maintenance record card on which space is provided for indicating dates of cleaning lamps and shades, voltage of lamps to purchase and size of fuses for circuits; also telephone number of lighting service department and name of service man.

Tangible evidence is presented by use of the lighting kit and the accessories as well as measuring the actual installation. The photo-cell usually creates considerable interest, particularly when it is demonstrated that any one can measure illumination directly with it. By showing the effect of using different voltage lamps, controlled or directed light (with collapsible reflector), dust-covered glass (really a glass screen equivalent to one month's dust accumulation), soiled or different wall and ceiling coatings, etc., the customer is able to visualize what general statements will never convey.

If the customer responds to an offer to have a lighting analysis made to show how light can be used to better advantage an analysis form is filled out in duplicate. On the back of the carbon, given to the customer, are concise comments on location of outlets, adequate wiring and how to get the light paid for. If possible, the customer is urged to accompany the service man in the analysis as his presence permits discussion of the importance of light in each section of his business. Emphasis is placed on value of controlled light to make displays effective, the ease of making changes, the importance of proper spacing of fixtures and the colors of walls and ceilings to utilize light efficiently.

The service man is not permitted to monopolize the talking, but gives the customer a chance to express viewpoints, as his comments usually give an opportunity to clear up many misunderstandings and also show the sales value of effective lighting.

After the analysis and recommendations are made it usually develops that the customer desires an estimate on making the changes. He is recommended to consult the person who usually does his electrical work, or is given the name of the local contractors' association for advice.

If objections to the cost of revamping are raised, it is compared with the cost of some product sold by the customer (previously observed) to show that it can be readily offset by the increased sales stimulated, reduced returns or delivery expense which can be effected by affording customers a better opportunity to examine purchases, or observe products that might not have been considered for purchase when the customer entered the store.

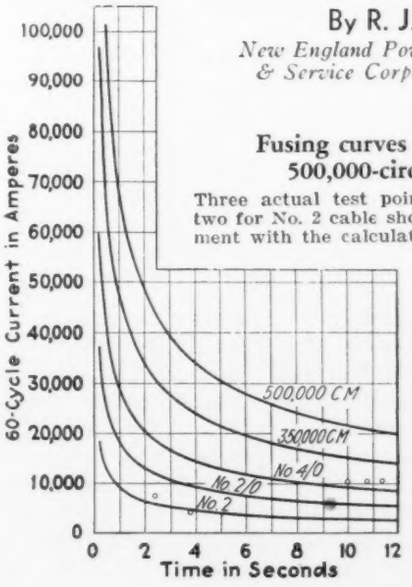
Upon leaving, the service man reminds the customer that he is always ready to be of assistance on any lighting problem and calls attention to his name and telephone number on maintenance schedule.

So effective have been these service calls in attaining the results previously mentioned that a similar plan is being applied to industrial customers. Owing to the limited number of trained lighting service men and kits, the chief attention so far has had to be given to customers who have complaints. However, the service will be extended as man power is developed, as it has become evident that this service approach is more effective than high-pressure or specialized selling in general terms. It renders an immediate help to the customer, inspires confidence and often reveals other worth-while applications of electricity which might never be brought up otherwise except in delayed fashion. In this approach are seen opportunities to observe industrial process problems that may be solved with electric power or heat which the power salesman might not have the opportunity to discuss under receptive conditions if he made an ordinary call to ascertain opportunities for more applications.

▼

Short-Time Fusing of Copper Cables

By R. J. COE
New England Power Engineering & Service Corporation, Boston



Fusing curves for No. 2 to 500,000-circ.mil cable

Three actual test points for No. 4/0 and two for No. 2 cable show fairly close agreement with the calculated values.

In the design of station ground bus systems a fundamental consideration is to provide conductors large enough to carry maximum expected fault current at any point without fusing before automatic circuit breakers can operate to clear the trouble. By making a number of assumptions, a formula can be derived from which the time required to fuse a conductor at any given current may be calculated, provided the fusing time is short, ten seconds or less. This formula is based on the principle that the I^2R loss in the cable all goes to raise the temperature of the conductor from its initial temperature to its melting point and no energy is lost or radiated. The initial temperature is taken as 25 deg. C. and for copper the final temperature as 1,083 deg. C.

In addition it is assumed that the specific heat and resistance temperature coefficient of copper remain constant over this wide range of temperature. The error introduced by these assumptions is slight. The final formula becomes:

$$I = 0.137\, a \sqrt{\frac{1}{s}}$$

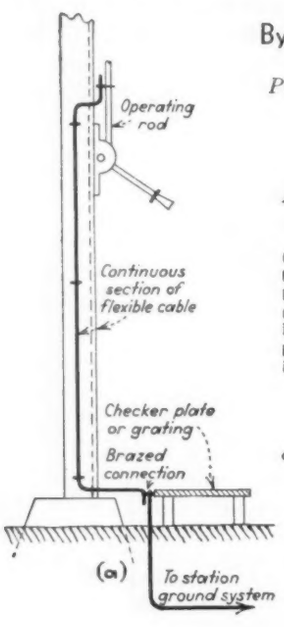
Where
I is the effective current in amperes (60 cycle)
a the cross-section of conductor in circular mils
s the time in seconds required to fuse.

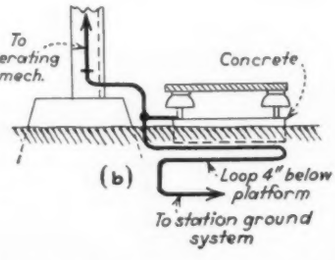
The family of curves shown is plotted from this formula for wire sizes commonly used in ground bus work.

▼

Insulated Stool Preferable for Safety on Switch Operation

By WALTER B. MORTON*
Project Engineer
Philadelphia Electric Company





Alternatives to safety at outdoor switch stations

(a) Switch-operating handle grounded to grounded metal platform.
(b) Looped ground lead under insulated platform gives local potential isolation in case of insulator failure.

The custom of grounding the operating rods of high-tension switches has become practically universal. With the grounded handle, the connection between the operating rod and the structure, and between them both to ground, is normally of very low resistance and the potential difference possible between these points is correspondingly low. For this reason, theoretically, no further protection would ordinarily be required in an efficiently grounded station. In actual practice, however, it appears desirable to provide some form of safety operating platform. This platform may be an insulated stool, isolated from ground, or a grounded platform, the latter consisting of a metal plate or grating, directly bonded to the switch-operating handle and to the station ground system. This connection should be made with a continuous section of flexible cable to minimize the possibility of potential gradients which might result from poor contact between structure and earth ground or between structure and platform.

*All rights of republication reserved by author.

A selection between the two types is largely a matter of choice, although the insulated stool, aside from the disadvantages of higher first cost and greater periodic maintenance required, appears more desirable because of the added security which the insulators provide in the event (however remote) of poor contact or failure of ground connections which might tend to produce a potential gradient between the grounded platform and the mechanism on the structure.

Insulated stools may be portable or fixed, although the latter are preferable where space requirements or other limiting factors do not prohibit their installation. A portable platform is necessarily bulky and unwieldy, which discourages its use, especially during emergency switching when safety is most desired. A fixed platform with supporting insulators securely fastened to a concrete base provides ample assurance of its availability for use when required.

Indoor type insulators, although presenting a neater appearance than the outdoor variety, are not suitable for service on outdoor platforms because their effective insulation may be greatly reduced by accumulation of mud splashed over them during heavy rains. Insulators with wider petticoats and greater creepage area are to be preferred for outdoor service, although this is not so important if the structure-and-operating-handle ground connection lead is looped under the platform about 3 or 4 in. below grade to reduce the potential of the structure and switch-operating mechanism to that of the earth beneath the platform.

▼

READERS' FORUM

Utility Distribution of Industrial By-Product Power

To the Editor of the ELECTRICAL WORLD:

I have read with interest Dean W. Taylor's discussion "Approach to an Untouched Market." His proposal to the utilities to develop and distribute all possible by-product power in industry is very timely. If we are now only willing to meet each other on common ground we shall see a period of profitable evolution in the field of power.

In a comment to an editorial in *Power*, June 2, 1931, "Save the Power Pennies," I wrote the editor in part as follows: "To the eight principles of what *Power* stands for I would like to add one more, 'sell power when it should be sold.' If the three principles, 'making, buying and selling power' could be properly co-ordinated with the utility people the savings in power pennies would be mutual."

With all the data available as to what power should cost, the problem is comparatively simple. Yet there is ample proof that these principles have been violated.

Because the power companies carry the key to the solution of the problem, industry should be glad to co-operate.

ALFRED VAKSDAL,
Plant Engineer.
Corning Glass Works,
Corning, N. Y.

BOOK REVIEWS

Standard Handbook for Electrical Engineers

By Frank F. Fowle. Published by the McGraw-Hill Book Company, 330 West 42d Street, New York, N. Y. 2,790 pages, illustrated. Introductory price $6.

Electrical technology has expanded at a phenomenal rate and handbooks in such a field are perforce out of date before they become frayed. This sixth edition of the Standard Handbook, recreated by an array of 91 specialists and authorities co-operating with Frank E. Fowle, has several more sections and over 700 pages more of intensive data in it than the 1922 edition. The new sections cover electric heating, melting and welding, marine data and applications, electron tubes and wave filters, as well as an expansion of radio, carrier and wire communication. Merely the added material alone represents the equivalent of at least four regular 250-page, 100,000-word engineering treatises, so much has compact arrangement effected in keeping the encyclopedic contents within bonds.

In fact, the new handbook becomes more than ever the institution which it has always been since it first grew out of the pages of the ELECTRICAL WORLD 25 years ago. Since then 100,000 copies of the successive editions have been sold. To attest to the up-to-the-minute coverage of the latest edition one sees new material on dielectrics, rectification, metering, pole standards, alloys, relays, pulverized fuel, combustion control, plant wiring, gas-electric buses, vacuum tube applications, ultraviolet radiation, insulation co-ordination. One glance at this list shows that most of these topics were just in their infancy when the last edition was published.

In the effort to embrace between two covers the essential factual data which electrical engineers have primary occasion to use, some of the less pertinent matters of structural design and economic theory have had to be omitted. Consequently the increase in strictly electrotechnical data in the new volume signifies far more than the mere expansion in size. For the sake of having a single-volume summary of his factual requirements perhaps the electrical engineer will not rue the maturing of what started as a pocket book into a two-hand book that has to be $2\frac{3}{4}$ inches thick in order to embrace practically 2,800 pages of the thinnest practicable paper.

In short, whether he be a welding engineer, meter engineer, electronic engineer, railway electrical engineer or general practitioner in power fields, he will again find that the Standard Handbook contains the indispensable condensation of working data which he needs at his fingertips.

•

Die Electrischen Maschinen

(Electric Machinery)

By Dr.-Ing. M. Liwschitz. B. G. Teubner, Leipzig. 381 pages, 374 illustrations. Price, 18 reichsmarks.

This is Vol. 1 of a three-volume series and deals with fundamental principles. Details of construction are taken up in the second volume, while the third, as yet unpublished, is to contain a further development of certain chapters of the present book.

The new edition differs from the first, which was published in 1926, by the inclusion of new material, particularly a chapter on concatenated operation of asynchronous and commutator machines. While all the usual types of motor, generator and transformer are discussed, the consideration given to the types of alternating-current commutator machines is especially full. The treatment is from the viewpoint of the designer and user rather than of the theoretical analyst and is devoid of complicated mathematics.

•

Electric Wiring for Light and Power Installations

By A. L. Cook. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York. 453 pages, illustrated. Price, $3.

Advance of the art of wiring for light and power as reflected especially by changes in the National Electrical Code have necessitated a third extensively revised edition (second in 1923). Grounding is more completely treated in a wholly new chapter. Architects, contractors and electricians will find the book more helpful than ever in understanding lights, motors and protective control so that the modern types of wire systems for them may conform to established rules and best practice and thus execute safely the results ascertained by the computations which are detailed. Tabular data are extensive and the inclusion of several hundred questions adapts the book to trade school instruction and tests of applicants for licensing.

•

A.S.T.M. Tentative Standards, 1932

American Society for Testing Materials, 1315 Spruce Street, Philadelphia. 1,236 pages, illustrated. Price, cloth, $8; paper, $7.

All tentative standards, given approval in the various steps of A.S.T.M. procedure, are here published to facilitate the one or two years of practical trial accorded all such standards. Of the 226 new standards included there are fifteen pertaining to electrical insulating materials and others to magnetic tests, tests for embrittlement of structural steel, alloyed conductor tests, hard-drawn transmission copper, insulated wires and cables.

•

Radio Engineering Handbook

Keith Henney, editor-in-chief. Published by the McGraw-Hill Book Company, 330 West 42d Street, New York, N. Y. 574 pages, illustrated. Price, $5.

Twenty-two recognized radio engineering authorities collaborated with the associate editor of *Electronics* to produce the much-needed handbook for that field. The development proceeds from the common fundamentals for all electrical engineering into the special manifestations of the high-frequency circuit, accentuating the characteristics of inductance, capacitance and resonance.

Practical applications are interspersed with the fundamental principles where they will be most authentically interpreted. Treatment is inherently functional at all points rather than empirical. Comprehensiveness is attained by inclusion of chapters on code radio, acoustics, photoelectricity, television, sound pictures, aviation radio, etc. Continuity and logical arrangement are so well observed that the handbook has distinct textbook merits.

Men of the Industry

J. F. Fogarty New President of North American Edison

James F. Fogarty, who was elected last week president of the North American Light & Power Company (ELECTRICAL WORLD, February 4, page 175), has also been elected president of North American Edison Company, principal subsidiary of the North American Company,

©Bachrach

to succeed the late Edwin Gruhl. Mr. Fogarty is also vice-president of the North American Company, having held that office for the past ten years. Frank L. Dame, chairman of the board and president of the North American Company, continues as chairman of the board of North American Edison Company.

A native of Philadelphia, Mr. Fogarty entered the electric light and power industry 30 years ago as a stenographer for the North American Company and by successive advances became assistant secretary in 1910, secretary in 1912, a director in 1914 and vice-president in 1923. During the greater part of his long period of service he has been intimately in contact with the important corporate and financial affairs of the company and its subsidiaries. He has been vice-president and director of North American Edison Company since its organization and is also an officer and director of 28 other companies.

FREDERICK W. DOOLITTLE, vice-president and director of the North American Company, was elected vice-president and director of North American Edison Company and HERBERT C. FREEMAN, vice-president and director of the North American Company, was elected vice-president of North American Edison Company, of which he is also a director.

▼

CLAXTON E. ALLEN, commercial vice-president of the Westinghouse Electric & Manufacturing Company, who for the past two years has been in charge of the manufacturing and sales activities of the merchandising department at East Pittsburgh, Pa., has returned to St. Louis, Mo., to take over active management of the company's interests in that territory. Prior to his transfer to East Pittsburgh Mr. Allen was district manager of the Westinghouse company in St. Louis.

•

DR. ARTHUR E. KENNELLY, professor emeritus of electrical engineering, Harvard University, has been elected president of the International Scientific Radio Union, succeeding the late Gen. Gustave A. Ferrie.

▼

V. E. Bird Made President of Connecticut Utility

Viggo E. Bird, formerly vice-president and general manager of the Connecticut Power Company, New London, has been elected president of that company to succeed Samuel Ferguson, who has been elected chairman of the board of directors. Mr. Bird is also executive vice-president of the Hartford Electric Light Company. He has been prominently identified with the electrical industry in New England for a number of years, having been associated early

in his career with Hammond V. Hayes, consulting engineer of Boston; the Boston office of Stone & Webster, the Blackstone Valley Gas & Electric Company and the Fall River Gas Works Company. In 1913, when the Stone & Webster interests purchased the Connecticut Power Company, he was sent as manager to New London. In addition to serving as an officer and on the directorate of several public utility companies, Mr. Bird is also an officer and director of financial and industrial corporations. He is a member of the American Institute of Electrical Engineers and of other technical associations.

OBITUARY

Delos E. Parsons

Delos E. Parsons, since 1928 New York district manager of the Railway & Industrial Engineering Company of Greensburg, Pa., died January 28, at his home in Millburn, N. J., after a four months' illness. Mr. Parsons became identified with the Railway & Industrial Engineering organization in 1925, when he severed his connection with the electric light and power industry in the Middle West to direct the sales staff in Philadelphia. A graduate of the West Virginia University, he joined the Westinghouse Electric & Manufacturing Company, where from 1903 to 1916 he obtained a wealth of engineering experience in various departments. Severing his association with Westinghouse, he became general manager of the East St. Louis & Suburban Railway Company and a group of allied public utility companies in and near East St. Louis, Ill. While a resident of Illinois he was active in the affairs of the electrical associations, having been past-president of both the Illinois Electric Association and of the Illinois Railway Association. Mr. Parsons was 51 years of age.

▼

FRANK E. SMITH, industrial engineer and formerly president of Servel, Inc., died February 7 at the Engineers' Club, New York, at the age of 55. Mr. Smith relinquished the presidency of Servel last year, after having occupied the office for four years. Before affiliating himself with Servel in 1927 he acted as consultant on financial and industrial problems, reorganizing many companies of varied sorts. Mr. Smith was a native of Providence, R. I.

•

JOHN B. LORD, chairman of the board of the Ayer & Lord Tie Company, Chicago, and dean of the wood-preserving industry, died January 21 in his eighty-fourth year. Though a native of New England, Mr. Lord as a young man went West, where he engaged in the grain buying and transportation business for Reynolds Brothers of Toledo. Later becoming interested in the production of cross ties and timber products in the Indiana, Illinois and Missouri districts, he formed, with T. C. Powell, the firm of Lord & Powell. In 1893 he became associated with Edward E. Ayer, a pioneer in the cross tie and telephone pole business, and they formed the Ayer & Lord Tie Company with general headquarters in Chicago. This organization's initial entry into the timber-treating field was made in 1903 and the tremendous growth in the preserved forest products industry from that time up to the present owes much to Mr. Lord's vision and enterprise.